2.01.00 WORK AREA PROTECTION

2.01.01 GENERAL:

This section outlines the work area protection necessary to protect company employees and pedestrians, maintain safe traffic control and minimize economic loss.

This section describes typical standards, the use of barricades and other warning devices and in no way precludes the use of additional or altered controls to meet special field conditions.

2.01.02 PURPOSE:

The fundamental purpose of a work area protection system is to separate the work area from traffic area.

This is accomplished in three ways:

- By Warning
- By Guiding
- By Protecting

No work area protection system is complete without all three.

Warning gives the public notification that they are approaching a work site.

Guiding devices channel traffic safely around the work area. These directions should be simple and clear. These devices should be easy to see and placed well ahead of the work area. Warning signs should be placed so as to be visible at all times.

Protection gives safety to the public and employees by the proper placement of vehicles, equipment, barricades and spoil banks.

2.01.03 BASIC RULES:

- Before leaving the yard check the work area protection equipment on the truck. Determine all safety equipment requirements. These requirements include:

Lights	Signal flags
High flag standards	Warning signs
Extra barricades	Special barricade rope
Extra cones	Flagmen or policemen

- On arrival at the job site the truck should be placed as a barricade between the work area and oncoming traffic.

- Look over the work area and plan the arrangement of the protective equipment, taking into account the following:

- The speed and quantity of traffic (on foot and in vehicle)
- Curved or straight road
- Hilly or level road
- Flat or crowned road
- Curbs, deep gutters and pedestrian sidewalk access
- The location and angles of intersections
- Visibility: good or poor
- Weather: clear, rain, fog, sleet or snow
- Condition of road: dry, wet, icy, slushy or snowy
- Day or night

- Assign one or more flagmen for temporary protection while setting up the equipment. If conditions require, permanent flagmen should be used. Request assistance of local and state police when required.

- High visibility vests and/or uniforms shall be worn by workers when exposed to vehicular traffic.

- The work areas (described in sketches on the following pages) shall be clearly indicated by barriers, flags, traffic cones or combinations arranged to safely channel traffic around the area. Traffic cones should be spaced a maximum of twenty-five (25) feet apart. Advanced warning signs shall be properly placed to alert drivers to conditions ahead.

- Materials or equipment, which may have to be left on the job unattended, shall be placed so that they afford minimum interference with traffic and blocked so that they cannot be easily moved. Work area protection shall be placed around the material or equipment.

- During hours of darkness, the work area shall be illuminated with electric flashers or combinations of other approved equipment.

- Job site shall be kept clean at all times to avoid tripping, falling or other hazards.

- Shoring is to be considered part of work area protection and shall be used as required.

- The public shall be guarded from sparks and radiation from welding operations and chips or flying particles by suitable screens, barriers and warning signs.

- Pedestrians shall not be permitted to enter the work area.

- Perform all blasting operations in accordance with all prescribed regulations.

2.02.00 WORK AREA PROTECTION EQUIPMENT

Traffic Cones

Flasher Lights

Flags

Steel Plates

Barricades

Traffic Cone Flag Holders

High Flag Standards (Free Standing)

High Visibility Clothing

Flag Standards (For use with barricades)

"Soft Trench" Signs

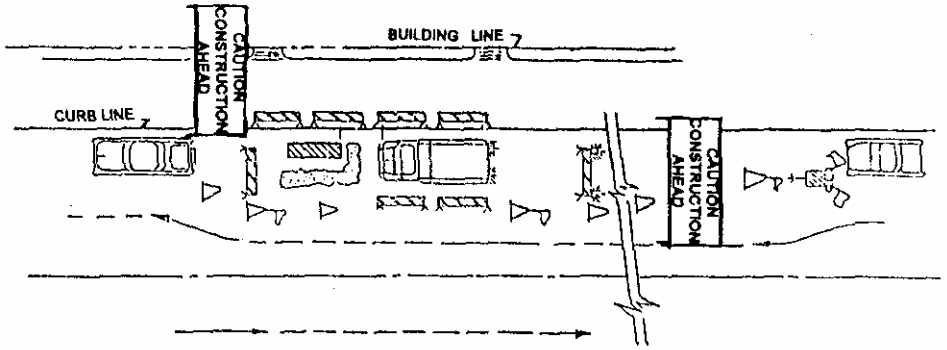
Signs for Highway Work

"Men Working" Signs

- Caution Construction Ahead
- Slow Single Lane Ahead
- Slow No Passing
- End of Construction
- Flagman Ahead

Supports for Highway Signs

2.03.00 WORK AREA PROTECTION PROCEDURES



2.03.01 EARLY WARNING:

Place the first warning device well in advance of job site. A minimum of 150 to 200 feet is recommended for city work, while 500 to 1,000 feet is recommended for open highways. Place the first warning device so it can be seen but not hinder the flow of traffic.

2.03.02 USE TRUCK AS SHIELD:

If feasible, place the truck between the flow of traffic and the work area in such a position that the rear of the truck is facing oncoming traffic. Vehicles with rear mounted

backhoes will require additional work area protection. Signal lights and flashing lights on trucks should be used to provide further protection.

2.03.03 BARRICADING WORK AREA:

Set up adequate work area protection equipment. The main reason for using work area protection equipment is to prevent accidents.

2.03.04 NARROW STREET:

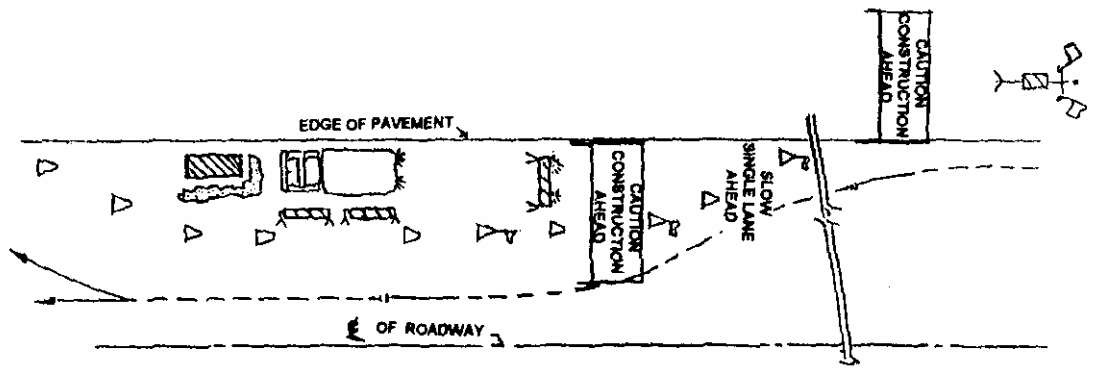
Narrow streets having two-way traffic need warning signals at both ends of the job site to alert drivers and give them a chance to pass safely.

2.03.05 EMPLOYEE SAFETY:

All employees shall stay within the protected work area.

2.03.06 SPOIL BANK AS SHIELD:

When possible, locate the spoil bank on the side requiring the most protection.



2.03.07 MINIMIZE CONGESTION:

Keep other vehicles from stopping or parking opposite the job site. Consider use of "No Parking" signs or barricades to keep work area clear.

2.03.08 REARRANGE PROTECTION:

When necessary, rearrange the work area protection as the job progresses.

2.03.09 BARRICADE REMOVAL:

At the completion of a job, assign a flagman while the work area protection equipment is being removed.

2.03.10 NIGHT PROTECTION:

If the job is to be left for the night, make sure it is adequately protected and that flashing lights are properly placed. Open lights are not permitted.

2.03.11 STEEL PLATES:

Steel plates may be used to safely cover trenches and maintain vehicular or pedestrian traffic flow. At night they may be used to permit unobstructed use of street.

2.03.12 MUNICIPAL ASSISTANCE:

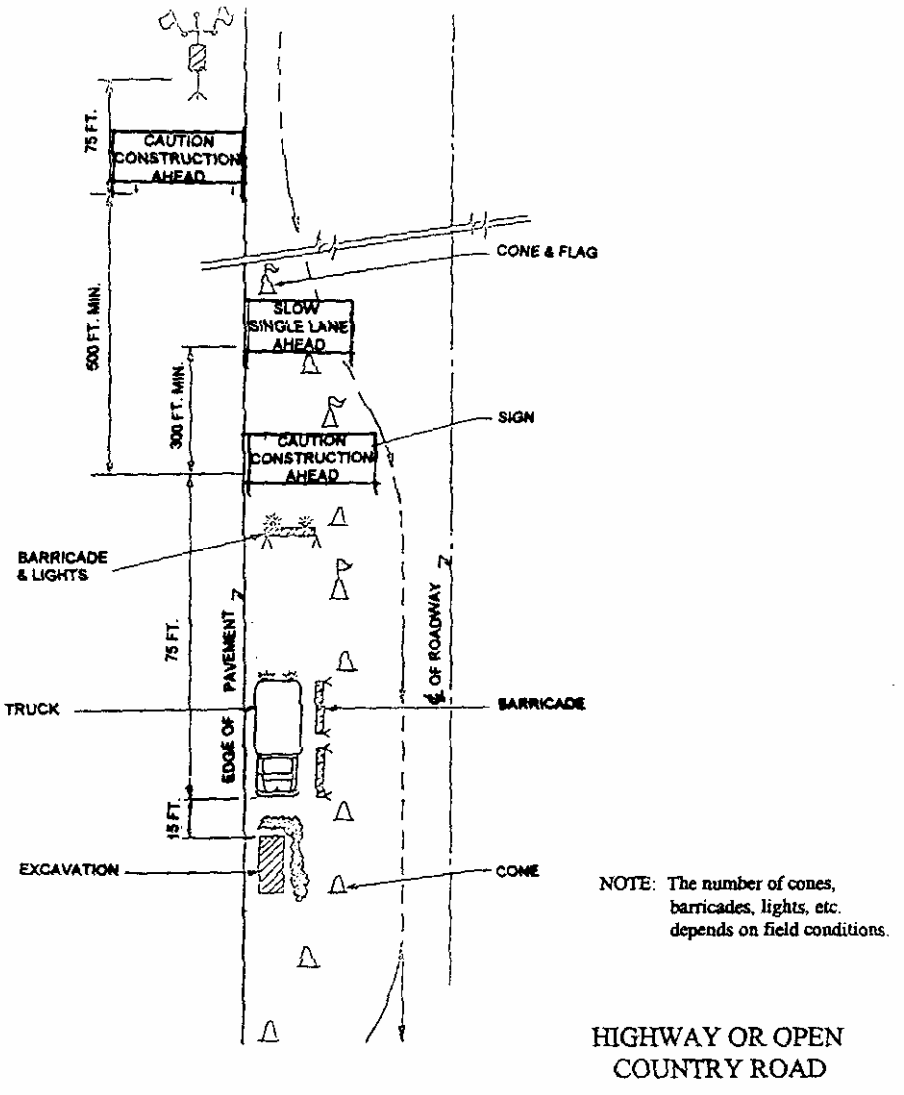
Certain operations may require special permission or assistance from municipal authorities. Such assistance shall be utilized when required.

2.03.13 REGULATIONS:

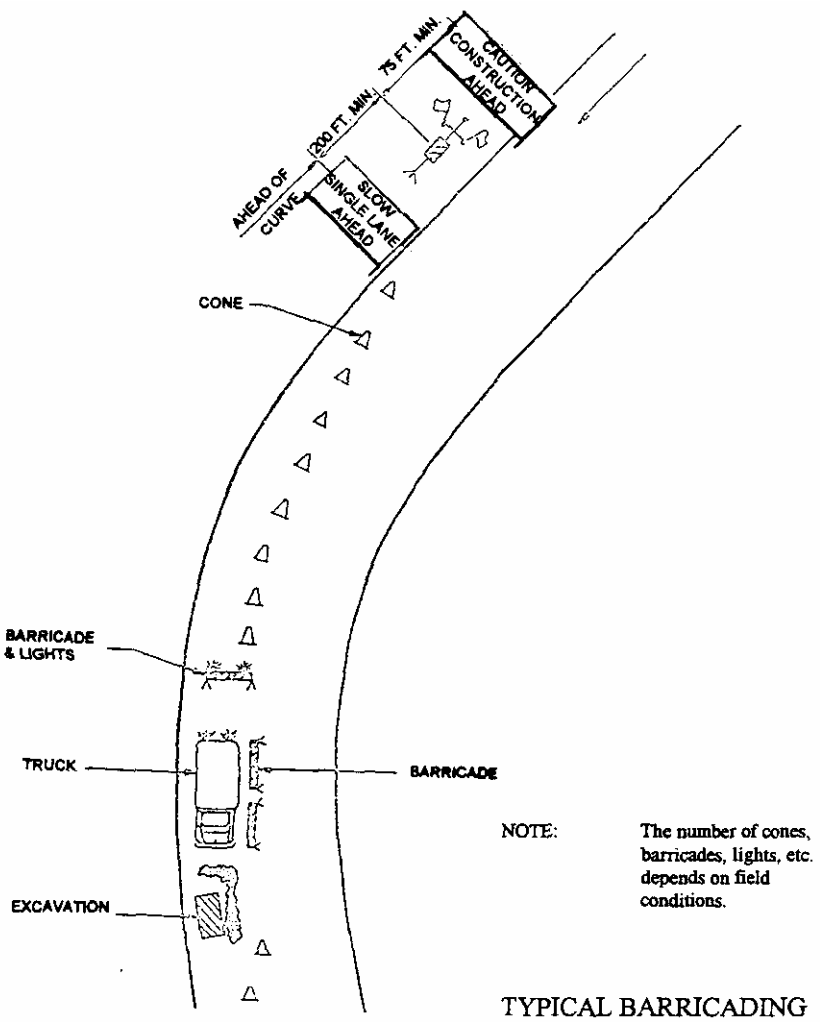
Federal, state and local rules and regulations regarding protection devices and signs shall be followed.

2.03.14 WORK AREA PROTECTION - DIAGRAMS

2.03.14.1 Highway or Open Country Road



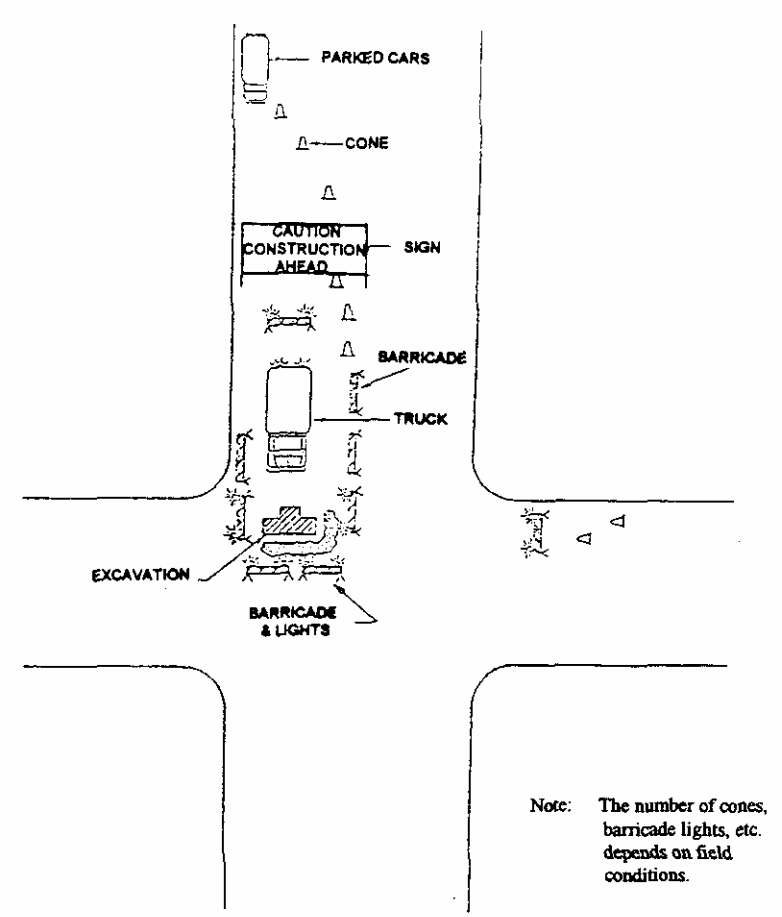
2.03.14.2 Typical Barricading of Opening on Highway at Curve or Hill



NOTE: The number of cones, barricades, lights, etc. depends on field conditions.

TYPICAL BARRICADING OF OPENING ON HIGHWAY AT CURVE OR HILL

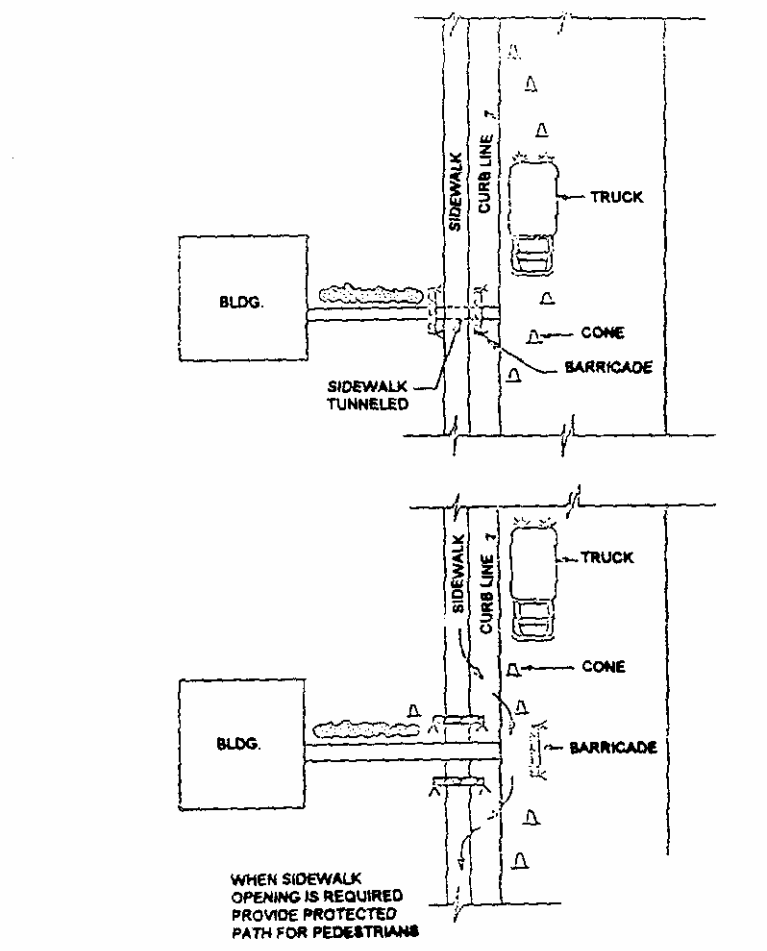
2.03.14.3 City Intersection



Note: The number of cones, barricade lights, etc. depends on field conditions.

CITY INTERSECTION

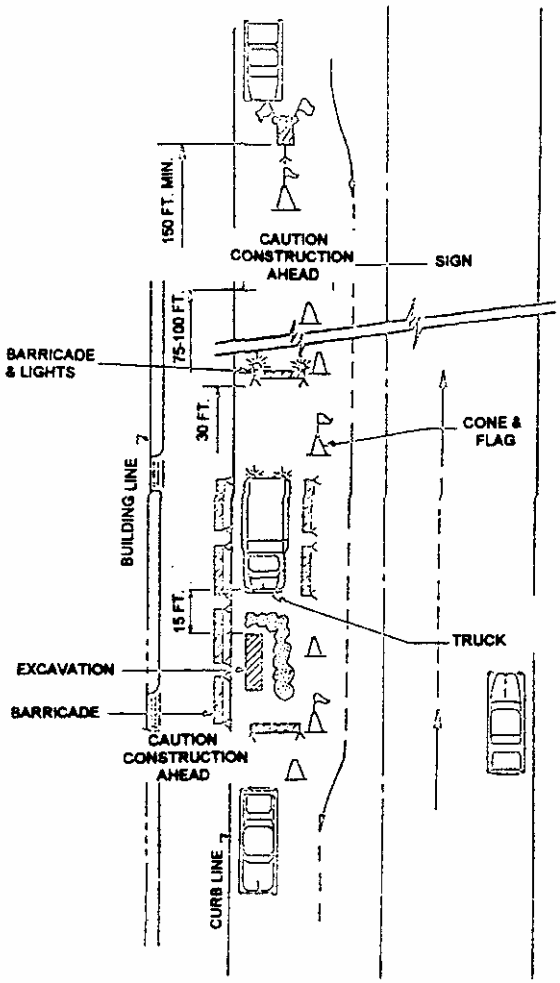
2.03.14.4 Sidewalk Openings



Note: The number of cones, barricades, lights, etc. depends on field conditions.

SIDEWALK OPENINGS

2.03.14.5 City Street



Note: The number of cones, barricades, lights, etc. depends on field conditions.

CITY STREET

2.04.00 PROTECTING UNDERGROUND FACILITIES

2.04.01 GENERAL

- State and Federal laws require that individuals, contractors, municipalities, counties and the State inform the Company of any work to be done near gas facilities.

- The Company's program to prevent damage includes, but is not limited to:

  - Securing notification of intended construction from individuals, contractors, engineers, architects, utilities, municipalities, counties, state or federal agencies.

  - Notifying the parties involved of the existence and location of Company facilities.

  - Marking locations of Company facilities for the contractor at the job site once notified of construction activity (see O&M Procedure 2.06.00).

- All employees should report any construction near our gas facilities.

- Upon receipt of a Dig Safe notice, the Dig Safe Coordinator shall determine if gas facilities are located within the limits of the project. If so, the Dig Safe Coordinator will mark gas facilities within 72 hours as required by Dig Safe laws. Markings shall be placed according to O&M Procedure 2.06.00.

- Telephone calls from contractors and others seeking emergency information on gas facilities shall receive prompt attention.

- Letters of notification from contractors and engineering firms must be answered by letter when required.

- The Company will issue maps showing the size and location of underground gas facilities to municipal, county, state and consulting engineers when requested for specific projects. Maps will be current and show when last updated.

- When possible, a Company representative should confer with the contractor prior to the start of construction and review the gas facilities that may be involved. He should also inform the contractor of the care necessary for protecting these facilities.

- The Company will mark the location of gas facilities for contractors in the field using yellow flags, stakes or paint markings. Use pipe finders or other reliable methods to locate gas facilities (see O&M Procedure 2.06.00).

- On large projects where construction prints are available, the Company will give to the contractor a marked construction print showing the general location of gas facilities. Indicate that prints are for design use only, not excavation.

- Warn contractors to use hand tools for final excavation near a gas facility and to avoid striking it with excavating equipment, timbers, pipe being installed or loads of backfill. Gas facilities should not be used to support platforms or other utilities.

- Identify construction work, which may involve gas facilities and could create a hazardous situation, to the contractor's immediate attention. Notify the Manager of Gas Systems or designee immediately.

2.05.00 DAMAGE PREVENTION PROGRAM

2.05.01 DIG SAFE

Title 49 Section 192.614 of the Code of Federal Regulations requires that each operator of a buried pipeline has and follows a written program to prevent damage from excavation activities. To a large extent, FG&E is covered by their participation in the Dig Safe One Call system and activities to be performed by Dig Safe.

Program

- Dig Safe and the Massachusetts One Call Underground Damage Prevention system, will identify on a current basis all persons who normally engage in excavation in the state and contact them annually to make them aware of the Damage Prevention Program, its purpose, and how to learn the location of underground pipelines before excavation starts.

- The Company will periodically notify the public of the existence of the Damage Prevention Program, its purpose, and how to learn the location of underground pipelines before excavation activities are begun.

- Dig Safe will continue to receive and record notification of planned excavation activities and forward that information to the Company.

- The Company will notify contractors of its underground piping by marking locations with yellow spray paint in accordance with Dig Safe conventions within 72 hours after the contractor has called. Stakes or flags may be used in unpaved areas (see O&M procedure 2.06.00).

- If blasting will be part of an excavation, the Company will verify the integrity of its pipeline system in proximity to the blasting with a survey both before and immediately after the blasting. The survey will be conducted using combustible gas indicators, flame ionization equipment, infrared equipment and/or other industry accepted testing equipment. Since the excavator is required to notify Dig Safe 24 hours before blasting, the leak surveyor should meet with the blasting engineer within 24 hours of the time on the Dig Safe ticket and preferably on the same day that blasting will begin. At the meeting and prior to the blasting, the leak surveyor should discuss the location and direction of the blasting with respect to gas facilities. A review of the maps and records should indicate the gas facilities pressure (e.g.

low, intermediate or high pressure) and material (e.g. cast iron, bare steel, and plastic).

The leak surveyor should also discuss the following with the blasting engineer:

The type and condition of the soil in the area, the size, type, location and direction of the charges and the possible impact on gas facilities. Based upon this review, the surveyor should conduct a pre-blast leak survey of gas facilities in proximity of the blasting. Immediately after the blasting, gas facilities closest to the location and direction of the charges should be resurveyed. If the survey indicates that facilities have been damaged, the surveyor should investigate and classify the leak according to the O&M Procedures 2.21.00 and 2.22.00 and promptly notify the dispatcher and the Manager of Gas Systems that a crew is needed at the location to repair the damage to gas facilities caused by blasting activities.

Maintain records to substantiate results of pre- and post-blasting surveys.

2.06.00 GENERAL LOCATING AND MARKING PROCEDURES

CAUTION: These procedures are not designed to accommodate every field condition that might be encountered in the course of performing a locate. These procedures are to be followed as a prudent operating practice. Where the guide cannot be applied and your experience cannot resolve the situation, do not hesitate to seek further specific direction from the Manager of Gas Systems.

- Read DIG SAFE ticket thoroughly, specifically the location description, house number, street name and town. Locate and verify the nearest cross street to the location.

- Look for any white layout pre-mark areas. If the DIG SAFE law requires pre-marking in your state and you don't find any markings, layout the gas locate as usual and document on the ticket that there were no pre-marks. Do not assume any previous gas markings are still in place and do not assume previous yellow marks are correct. Confirm and adjust according to your own findings.

- Establish a safe operating base. Place your vehicle to protect the anticipated work area. If the job is of any length, ride the route checking for dogs and other related security or safety issues.

- Report premature digging to the Manager of Gas Systems immediately.

- Activate safety flashers and wear proper safety gear. Set up cones, barriers and roadway alert devices as required by state, local and federal mandates.

- When possible, talk with contractor and confirm the nature and location of the proposed excavation. When possible, verify that the excavator understands

the location of the facilities and marks that will be left. Document on the ticket who you spoke with and any long term construction agreements made.

- Look for isolated grounding and connection points for your locating equipment.

- Review the plans and sketches. Ensure that the drawing accounts for existing structures. Porches, patios, fences and driveways are often installed after the gas service. Old buildings are often razed and replaced in downtown areas and streets are widened. Be aware that Company plans and sketches may not be complete.

- Observe the street in comparison to plotted features. Always look for gas valve boxes, risers and outside meters. Look for evidence of buried water, sewer, electric, telephone and cable. Look for new utility construction or repair patches. If necessary, call Plant Records for further record assistance.

- Based on the pipe material to be located, select the proper instrument and locating technique. Physical direct conductive locating is the preferred technique. Use tracer wire where available for locating on plastic pipe.

- In areas where there are inside meters always attempt to gain access to make physical contact upstream of any insulator as close as possible to the service entrance at the wall. When unable to get in, leave a "CGI" card explaining the need to locate the facilities.

- Always begin with a 50-foot radius, 360-degree sweep of the area to pick up any multiple signal paths. Set signal generator/locator antennae as described in the user manual. Ensure that the equipment is connected with proper continuity. Insure no service or mainline insulators interrupt the signal circuit. Use caution in determining the signal generating/grounding structure to avoid confusing the two. Water hydrants, chain link fences and electrical grounding devices should be suspect when utilities parallel each other – above as well as below ground. If in doubt, call concerns to the Dig Safe Coordinator before the ticket expires. In all such situations document the particular concerns on the ticket, who was called, and what was discussed.

- Inductive locating should be well thought out. Be aware of other utility structures close by, either overhead or below ground. Know your locating device in order to keep the required distance from the transmitter.

- Use plans and records as an added means to layout and locate underground facilities. Before you leave the site be sure that the locate is correct and matches the records, the locating technique and your observation of the physical surroundings. Document any concerns.

- Mark using appropriate marking methods in accordance with current DIG SAFE laws and standards. Current regulations require using the center line method (Reference 220 CMR 99.05). Mark all facilities by printing the letter G or the

word GAS, the material, and pipe size for facilities over 2" diameter. If two parallel mains exist in the same area mark both clearly. Weather, flooding or other field conditions may dictate the markout materials and methods to be used such as offset stakes, pole tags and "Stake Chasers".

- Mark all service branches at the main. Mark services on curbs and at some offset point outside the work (on private property if necessary) to preserve the marks.

- Paint all valve, drip and test boxes.

- Place markings a maximum distance of every 50 feet – you must be able to see a mark in front and a mark in back of you.

- Audit your work for sufficient markings and proper layout. Check marks and satisfy yourself that you could trace the facilities walking back along the route.

- When complete pick up all equipment and supplies used in the work.

- Complete work order and all associated documentation. Note any errors found in the maps. Update maps, service cards and databases as required and file appropriately at the end of the day.

- Walk around the truck to see that nothing is in the way or left behind

2.07.00 EXCAVATION PROCEDURE

The following list of items shall be adhered to in all instances where any type of excavation related to gas facilities is to take place.

- Prior to excavation, a check shall be made to insure that all sub-structure utilities or installations are located (i.e. "Dig Safe" where applicable).

- Adequate barrier protection shall be set up to insure safety and proper work area protection in and around the excavation area.

- All boulders, trees or other surface impediments, which will create a hazard in the excavation area, shall be removed or made safe before excavation begins.

- Workers shall make inspections daily and take appropriate steps to make the excavation area safe.

- The walls and faces of all excavations in which employees are exposed to danger shall be made safe by shoring or other suitable means.

- In all instances, spoil from the excavation shall be stored and/or retained at least 2 feet or more from the edge of the excavation.

- Diversion ditches or dikes shall be used where the possibility of surface water entering the excavation occurs.

2.08.00 TRENCHING PROCEDURE

Trenches more than 5 feet in depth shall be shored, laid back to a stable slope, or some other equivalent means of protection shall be provided where employees may be exposed to moving around or cave-ins (see table and diagram on next page).

The decision to install shoring, sheeting or other suitable means of protection in trenches less than 5 feet in depth due to recent excavations, unstable soil conditions, heavy vehicular traffic or other reasons shall be made by the person in charge at the job site.

When installing shoring and/or sheeting, the following rules shall be adhered to:

- All materials used for shoring and/or sheeting shall be in good serviceable condition, and designed and installed so as to be effective to the bottom of the trench or excavation (see table and diagram on next page).

- In trenches 4 feet in depth or more, a ladder shall be provided so as to require no more than 25 feet of lateral travel.
- Cross braces or trench jacks shall be in a true horizontal position.

- Portable trench shields may be used in lieu of shoring and/or sheeting.

- Shoring, sheeting or other suitable means of protection from moving ground or cave-ins shall be left in place until the backfilling is to take place.

- Jacks and braces shall be removed starting at the bottom of the trench and moving upwards.

- Jacks and braces shall be released slowly and where possible, ropes shall be used to pull the jacks and braces from the trench.

TIMBER TRENCH SHORING - MINIMUM TIMBER REQUIREMENTS*

SOIL TYPE C P_a = 80 x 11 + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **																
	CROSS BRACES									UPRIGHTS							
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN.)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)							
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE							
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6							
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6							
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6							
	See Note 1																
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6							
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6							
	See Note 1																
	See Note 1																
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6							
	See Note 1																
	See Note 1																
	See Note 1																
OVER 20	See Note 1																

* Mixed Oak or equivalent with a bending strength not less than 850 psi.

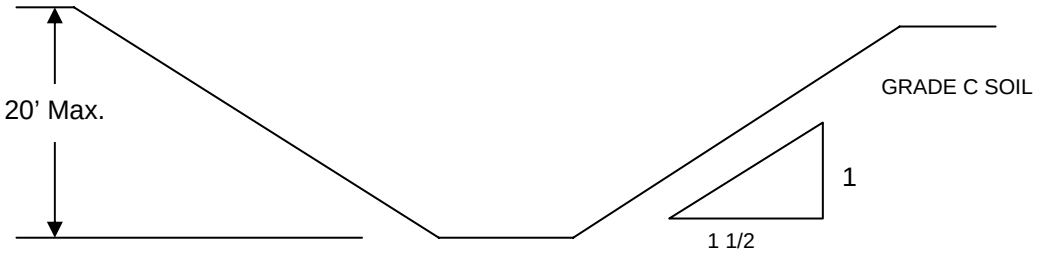
** Manufactured members of equivalent strength may be substituted for wood.

VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

B–1.3 Excavations Made in Type C Soil

1. All simple slop excavations 20 feet or less in depth shall have a maximum allowable slope of 1 ½ :1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 15 inches above the top of the vertical side.

All such excavations shall have a maximum allowable slope of 1 ½ :1.

2.09.00 WAREHOUSE INSPECTION OF PLASTIC PIPE

When a shipment of plastic main or service pipe is received the shipment shall be inspected to assure that material is the correct material and free from defects.

A representative from the Stockroom will examine the condition of the pipe surface to ensure there are no significant scratches or other surface defects. Wall thickness, OD and ID will be checked. The maximum allowable depth of a slice or scratch on the pipe is 10% of the wall thickness. The maximum variance of wall thickness and internal diameter is 10%. Questionable material should be brought to the attention of the Manager of Gas Systems.

If any dimensions are not in compliance with material specifications, the entire lot of pipe shall be returned to the supplier.

2.10.00 FIELD INSPECTION OF PLASTIC PIPE

The Distribution Project Leader and/or A-Leader shall check the status of work in the field. He will enforce procedures and examine methods of pipe joining. If in his estimation a joint or coupling seems suspect he has the authority to remove such joint or coupling.

Joints or couplings may be removed and tested at the discretion of the Project Leader.

2.11.00 DISTRIBUTION SYSTEM SURVEY

- A gas detector survey (using combustible gas indicators, flame ionization equipment, infrared equipment and/or other industry accepted testing equipment) shall be conducted on distribution systems in business districts. The survey conducted should include tests of the atmosphere in gas, electric, telephone, sewer and water system manholes, catch basins, at cracks in pavement and sidewalks, and at other locations providing an opportunity for finding gas leaks. Business districts are defined as areas within pavement from building wall to building wall and/or where the principle commercial activity of the city or town takes place. (49CFR 192.721, 192.723 220 CMR 101.06(21))

- A leak survey shall be conducted on distribution systems outside of business districts.

- Distribution system surveys of areas within business districts must be done at least once annually and at intervals not exceeding 15 months.

- Distribution system surveys outside business districts must be done at least once in every consecutive 24 month period.

- Mains in places or on structures where anticipated physical movement or external loading could cause failure or leakage must be patrolled at least four times each calendar year. The intervals between patrols cannot exceed 4 ½ months.

- Records of leak detection surveys must be made and retained for the period of time prescribed by regulations.
- Class 1 Leaks are to be re-surveyed 30 days after the leak is repaired.

2.12.00 FLAME IONIZATION SURVEY

- This survey may be used in either business or non-business areas. Flame ionization equipment is used to sample the atmosphere at ground level.
- When vehicle mounted, the unit is driven from 2 to 5 mph as closely over the main as possible.
- Leaks indicated by the flame ionization unit shall be verified and classified by making combustible gas indicator tests.
- Areas to be surveyed shall be indicated on maps and given to the Leak Survey Coordinator prior to the survey. As each section is surveyed, the Leak Survey Coordinator shall mark the map showing the area surveyed, the date and his initials. The completed maps shall be filed in the office.

2.13.00 PRE-PAVING SURVEY City and Town Paving Projects

Purpose: The following outlines the procedure for the identification of City and Town paving projects as well as the subsequent work processes required for maintaining regulatory compliance with chapter G.L.c.164, § 116B.

General:

1. The Gas Operations Manager and/or the Gas Construction and Maintenance Supervisor will contact each City and Town to outline their paving plans and schedules for the upcoming year.
2. Street restoration projects will be monitored utilizing the Dig Safe Dig Track System. As Dig Safe requests for street restoration projects, are requested and subsequently completed, the Dig Safe Technician will utilize close code 11 “street restoration” to close out the Dig Safe ticket. The Construction and Maintenance Supervisor will query the Dig Track system as often as required to stay up to date on street restoration projects.

Pre-Paving Leak Survey:

1. Upon receiving the paving list, the Leak Survey Coordinator will conduct a thorough leak survey of all mains and services in the proposed area.
2. The leak survey coordinator will communicate, any gas leaks identified, with the Construction and Maintenance Supervisor.

3. The Construction and Maintenance Supervisor will estimate the number of days required for repairs as well as the proposed repair schedule.

4. The Construction and Maintenance Supervisor will communicate the required repairs and proposed timetable to the various Cities and Towns.

5. All repairs shall be completed, prior to paving.

6. At the completion of the repairs, the Leak Survey Coordinator will complete another leak survey and clear the area.

7. Documentation

Structure Adjustment: (Valve Box)

1. For all street restoration projects the Construction and Maintenance Supervisor will identify the following:
    - Streets and proposed limits of the paving projects.
    - Project Scope (e.g. street only, street and sidewalks, etc)
    - The type of paving (i.e. cold plane or pulverization).

2. The Supervisor or Project Leader will research maps and records to identify any impacted structures.

3. The Dig Safe Tech will mark and identify all structures (e.g. gate boxes) as part of the Dig Safe mark out.

4. The Construction and Maintenance Supervisor will coordinate, with the paving contractor, the adjustment of any affected structures.

5. Structures adjusted

6. Documentation

2.14.00 WINTER PATROL SURVEY

Each year, the Company will conduct winter patrol surveys. These surveys are conducted in order to detect potentially hazardous situations caused by frost damage. Winter patrol surveys will be conducted on all mains in business districts and all cast iron mains in both business and non-business districts. Surveys will be conducted sometime between January 1 and March 1 but only after a reasonable frost penetration has occurred.

2.15.00 SERVICE LEAK AND CORROSION SURVEY

Each year, the Company will conduct walking surveys to identify potential service line leaks and corrosion on piping. 220 CMR 107.07. At a minimum, one third of the total number of gas services will be surveyed annually. The surveys will be conducted as follows:

2.15.01 OUTSIDE METERS:----------**

- Set the flame ionization unit on the most sensitive scale.
- Walk the service from the street to the outlet of the meter.
- If a leak is detected, set the unit to a less sensitive scale and soap the piping to pinpoint the leak.
- Mark the location of the leak whenever possible, note the service address, and notify the dispatcher or your supervisor.
- Make sure that the meter stop is easily accessible. If not, notify the Distribution Project Leader so that appropriate action can be taken.

2.15.02 INSIDE METERS:

Each year the Company will conduct interior gas leak and corrosion surveys of houses or buildings with inside meters and piping. These surveys will be conducted at a rate such that, at a minimum, one third of the total of the gas services will be surveyed annually. The leak survey procedure will be as described in sections 2.17.01 and 2.23.02.

2.16.00 PUBLIC BUILDING INSPECTION

The Company must keep a list of all buildings of public assembly which must be surveyed. The list must include:

- Schools – all school buildings including all institutions of learning from pre-kindergarten through university level.
- Nursing homes, orphanages and homes for the aged.
- Hospitals
- Theater buildings
- Churches
- Arenas

Conduct a survey of buildings of public assembly at least once annually. Include tests for gas leakage and visual inspection of gas facilities in the immediate area of the service entrance.

Inform the person in charge of the building the reason for the inspection.

Inspect the service entrance, the service regulator and gas meter installation for severe corrosion or other unsafe conditions.

Inspect for locking devices on inactive meters and services

Inspect the inside shut-off for condition and accessibility.

Make combustible gas indicator tests at meter installation, at point of entry of gas, water, sewer and duct lines and at any large cracks along street wall in the basement. Notify dispatcher if leaking gas is found to be entering building.

Visually inspect regulator vents to assure that they are clear. Any vent located so as to direct blowing gas toward a window or cause gas to enter the building shall be reported for relocation.

Verify that the curb valve is identifiable and readily accessible whenever a curb valve is installed.

Update and complete all necessary records.

Reference: 220 CMR 101.06 (21)

2.17.00 INTERIOR GAS PIPING CORROSION AND LEAK SURVEY

The MDTE requires the Company to conduct leak and corrosion surveys of gas company owned interior piping, meter fits and meters. Leak surveys and corrosion inspection should be conducted at a MINIMUM every 3 years, and whenever a technician visits any customer's property to perform the following work:

- Responding to an odor complaint
- Scheduled leak and corrosion inspection
- Any type of meter work (e.g. turn-ons, replacements) except reading the meter
- Any service work on a furnace or water heater

2.17.01 PROCEDURE:

If the purpose of the visit is to investigate an outdoor leak that does not require inside access, follow O&M Procedure 2.23.00.

If the purpose of the visit is to investigate an indoor leak, follow O&M Procedure 2.22.00.

If the purpose of the visit is to perform work on the gas meter, furnace or water heater, do the following:

- Turn on the combustible gas detection instrument in the outside free air, test batteries and zero the instrument.
- Using the combustible gas detection instrument, leak survey the company owned interior gas piping and inspect for severe corrosion. Begin at the meter outlet connection and survey the piping back to where the service line enters the building.
- Write down the observed reading (e.g. 0.00% gas) in the space provided or in the comment section on the work order.

2.17.02 EXCEPTIONS:

No leak survey is needed if:

- The gas meter is on a different floor than the furnace or water heater being serviced, or
- A locked door prevents access to the meter, fit or interior gas piping or
- The employee or company representative is solely reading a meter.
- If access is not possible, indicate the reason on your work order

2.18.0 DISTRIBUTION VALVE INSPECTION

General:
Maintain a continuing program to make gate boxes easily and immediately accessible as specified in 49 C.F.R. Part 192 § 192.181, 192.605(a), 192.605(b) and Massachusetts General.Law.c.164,§ 116B.

- Locate the valve box. Check existing measurements and correct to field conditions using above ground reference points if necessary.
- Check the valve box with a combustible gas indicator.
- If necessary, clean out the valve box so that the valve will be accessible for proper operation.
- Check the valve position.
  - Leave valve in same position as found.

- Indicate on the inspection record (below) the position found.

- Check the valve operation:
  - Normally open valves – crack valve towards closed position and reopen.
  - Normally closed valves – crack valve towards open position and reclose.
- Lubricate a valve only when it is leaking or if it is difficult to turn.
- Align the valve box and adjust it to proper grade.
- Recheck the valve box with a combustible gas indicator.
- Paint the top of the valve box if required.
- Complete the inspection record.(Below)

DISTRIBUTION VALVE INSPECTIONS FORM

VALVE I.D. #: INSPECTION DATE:_____
LOCATION: CITY:_____
VALVE SIZE: _____ VALVE TYPE: _____ VALVE MAKE:_____
1) EXISTING MEASUREMENTS ACCURATE: yes____ no____
2) CHECK VALVE BOX WITH CGI: yes____ no____
3) VALVE LEAKING: yes____ no____
4) WRENCH ON: yes____ no____
5) VALVE POSITION: open____ closed____
6) VALVE TURNED: yes____ no____
7) VALVE LUBRICATED: yes____ no____
8) VALVE BOX PROPERLY ALIGNED: yes____ no____
9) VALVE BOX TOP PAINTED: yes____ no____

IF THE ANSWER TO ANY OF THE ABOVE IS NO, PLEASE EXPLAIN.
COMMENTS /ADDITIONAL WORK NEEDED:

_____
_____
_____
_____

EMPLOYEE:_____
ENGINEERING VALVE I.D. #_____

2.19.00 Critical Valve Inspection

The Company will inspect all critical valves annually, the procedure is the same as for distribution valve inspections. See section 2:18:00 Distribution Valve Inspection

2.20.00 REPORTED LEAKS ASSOCIATED WITH DAMAGE TO GAS LINES

- On arrival at the location, check all buildings to determine the presence of gas. Follow the steps outlined in O&M Procedures 2.21.00, 2.22.00 and 2.23.00 as applicable.
- Evaluate the damage.
- Control the flow of gas using appropriate procedures
- Complete the necessary repairs
- Complete the required reports.

2.21.00 LEAK CLASSIFICATION

2.21.01 CLASS I LEAKS:

This classification includes gas leaks of sufficient magnitude that immediate repairs are indicated.

Involving public safety where leaking gas is:

- Near or entering a building regardless of the magnitude.
- In the ground adjacent to a building regardless of the magnitude.
- Continuous, positive combustible gas indicator readings in a manhole, or other street opening.
- Class 1 Leaks are to be re-surveyed 30 days after the leak is repaired.

2.21.02 CLASS II LEAKS:

This classification includes gas leaks that are not creating a public hazard at the time of detection. These include gas leaks where:

- In the judgement of the field supervisor the leak might develop into a Class I leak should changes occur, such as:
  - Frost penetration.
  - Paving installation or repairs.

- Severe drying or compaction of the soil.
- Construction in the area.
- Increases in the normal operating pressure of the piping system.

Report the probable events of concern on the leak report so repairs can be properly scheduled.

- The leak pattern of an otherwise Class III leak:

  - Has enlarged since the last field check.
  - Is abnormal.
  - Is contiguous with several Class III leaks.

- Gas in the ground near trees, bushes, significant lawn areas or other vegetation is affecting the growth.

- High combustible gas indicator readings are observed in remote areas.

- High combustible gas indicator readings are observed in curb boxes or street openings that are not connected by ducts, pipes or conduits to other street openings or buildings.

2.21.03 CLASS III LEAKS:

This classification includes gas leaks of a small magnitude that are not likely to develop into Class I leaks before repairs are made or the next leak survey.

2.22.00 <u>LEAK DISPATCHING PRIORITY</u>

Establishing a priority list for repairing gas leaks is to protect the public first and to protect structures and property second. Leaks that are known to endanger the public have the highest priority over any other type of work. Leaks are to be repaired in the order that the Grade classifications indicate. If several high priority leak calls occur at the same time, establish priorities within the Grade classifications to be certain that the leaks affecting the public are investigated and safely controlled first.

<u>RADIO DISPATCH CODE</u>

CODE 8 – Priority 1 (explosion)
CODE 7 – Priority 1 (gas inside building)
CODE 7 – Priority 2 (gas next to building)
CODE 7 – Priority 3 (gas odor in street)

ALL GAS LEAKS SHOULD BE TREATED AS <u>PRIORITY 1</u> UNTIL DETERMINED OTHERWISE.

REPAIR OR CONTROL ALL LEAKS, BEFORE ALL OTHER TYPES OF WORK.

- **PRIORITY 1 LEAKS:**
  Any leak that endangers public safety, repair or control gas leak immediately.

- **PRIORITY 2 LEAKS:**
  Any leak that is not endangering public safety but is next to a building or large enough to require immediate attention. Repair as soon as possible.

- **PRIORITY 3 LEAKS:**
  Any leak that is not endangering public safety or a building, repair or safely control.

- **PRIORITY 4 LEAKS:**
  Any leak that is turned in by survey or employee that is not of a higher priority, repair as quickly as normal work schedule permits.

- **PRIORITY 5 LEAKS:**
  Any leak that has been classified as a minor leak, repair as quickly as normal work schedule permits or reclassify.

2.23.00 FOREIGN ODOR COMPLAINTS

2.23.01 GENERAL:

- Investigate ALL foreign odor complaints immediately.
- Immediately after investigation, classify the leak.
- Assign a priority level for repairing the leak and dispatch accordingly.
- If found to be other than natural gas, notify the proper authority (i.e., Fire Department, Police Department, City).

2.23.02 BUILDINGS (INSIDE):

- Attempt to locate the source of the foreign odor. If the source cannot be located, make the area safe then notify the Manager of Gas Systems or designee.
- If a gas leak that cannot be easily and promptly repaired is found in the piping beyond the meter:
  - Turn off the meter.
  - Notify the owner, or tenant that the meter will be turned on after the leak has been fixed.

2.23.03 BUILDINGS (OUTSIDE):

- Attempt to identify the source of the foreign odor. If the source cannot be located, notify the dispatcher to send a street crew or flame ionization unit, or the Manager of Gas Systems or designee.

- If the source of the foreign odor is identified as gas escaping outside the building, notify the dispatcher to send a street crew. Wait for the arrival of the crew:

  - Examine other buildings on both sides of the street successively until no odor is found in two consecutive buildings.

  - If the leak is in an underground sewer or manhole:

    Check other manholes in all directions.

    Check all houses on both sides of the street up to the last manhole without gas.

    Report the address of all buildings checked and the combustible gas indicator reading obtained.

- Ventilate the rooms of all buildings where positive combustible gas indicator readings are obtained.

- If ventilation does not reduce the combustible gas indicator readings to a safe level inside the building, notify all occupants to leave the building. Shut off all gas equipment and appliances with open flames. Do not use electric switches in the room.

- If a building is not occupied, or if it is not certain that the building is occupied, and you consider it necessary to enter the building immediately to prevent a serious occurrence, call the Fire Department or Police Department as soon as possible to assist you. Notify your supervisor, as soon thereafter as possible. Make a full written report of your actions and your reasons for considering them necessary.

2.24.00 <u>RECORDS - LEAKS</u>

2.24.01 GENERAL:

Keep a complete written history of times and activities from the first notification of any leak to the final repair.

2.24.02 ITEMS TO REPORT:

- On appropriate forms, report the times of:
  - First notification.

- Dispatch.
- Arrival at site.
- Completion of repairs.
- Activities related to the leak.

- On appropriate forms, report these other items:

  - What was found.
  - Apparent cause of leak.
  - How repairs were made.
  - Injuries (names and addresses) and damages (describe).
  - Address and names of owners or tenants.
  - Measurements from a permanent reference point of leak and other work on gas facilities.
  - Opinion of odor level.
  - Estimate of gas pressure.
  - Opinion of condition of the exposed pipe.

2.25.00 PINPOINTING FOR LEAKS

- Determine the general area of the leak.

- Locate all other underground utilities before making test holes.

- Drill holes 4 to 12 feet apart determined by the extent of the leak. All holes must be the same depth, size and spacing.

- Test the holes with a combustible gas indicator.

- If you can get the largest concentration in a small area, then drill in between holes until you pin it down to one hole.

- If there is a 100% gas concentration in a large area:

  - Use aerator to air out holes, then retest to see which one builds up the fastest.

  - Test just the top of the hole with the probe. This will at times indicate the greatest concentration.

  - Use a film of soap and water or testing liquid on the hole to see if there is a positive pressure.

  - Use your sense of smell. Fresh gas will smell differently in the hole closest to the leak.

2.26.00 REPAIR OF GAS LEAK ON DISTRIBUTION MAIN

When the location of a leak has been determined, prepare the leak site as follows:

- Check all houses.
- Place a fire extinguisher near the work area where it will be accessible for immediate use.
- Expose the main at the area of the leak. Be sure to note the condition of the exposed pipe according to O&M Procedure 2.47.00.
- Repair the leak.
- Soap test the repair.
- Check the adequacy of leak repairs before backfilling. Check the perimeter of the leak with a combustible gas indicator.
- Check all curb boxes of services coming from the main in the area of the leak.
- If gas is present in the areas according to the previous two steps, additional leakage is present and shall be repaired.
- If the main segment is made of steel and shows signs of deterioration or mechanical damage, notify the Manager of Gas Systems or his designee. He will designate the segment as a candidate for replacement. If the main segment is made of steel and is in very poor condition, ask the Manager of Gas Systems or designee for authorization to replace the segment. Note the overall condition of the exposed pipe, any coating damage, any graphitization, the pit depth on steel pipe and describe the type of corrosion damage (e.g. uniform, general or localized corrosion).
- Repairs to metallic mains and services must consider the following: Piping material, i.e. Bare steel, cast iron, or coated steel; Repair method i.e. stainless steel band clamp, encapsulation device, or steel pin weldment; Residual gas in the trench atmosphere; Remaining wall (repaired) structural condition. Based on the above considerations employ the following guidelines:

    - On old bare steel mains, clean and coat the pipe with tape or mastic in accordance with the manufacturers recommended procedure.
    - On coated steel pipe that is cathodically protected with anodes, repair any coating damage and install a Type 1 or 2 test station and 17 lb. anode for “hot spot” protection. Then, run the anode lead up into the test box.
    - On rectifier protected lines, do not install any anodes directly to the pipe. Install a Type 1 or 2 test station (O&M Procedure 3.29.00) and if the corrosion engineer specifically request – drop an anode in the trench and run the anode lead up into the test box.

- Record locations of repair fittings on the work order.

- Backfill the excavation, restore the surface and fill barholes with approved tar plugs before leaving the work area.

2.27.00 UPRATING MAINS AND SERVICES TO HIGHER OPERATING PRESSURES

Perform all work to uprate mains and services for higher operating pressures according to existing codes. Review D.O.T. 49 CFR 192 Subpart K – Uprating. Maintain records of all work performed as long as facilities remain in operation.
Fitchburg Gas & Electric now uses high-density plastic pipe almost exclusively. Currently, the maximum allowable operating pressure for this pipe, based on federal and state codes, is up to 100 psig. The pressure rating may be increased in the future but until further notice, distribution systems will be designed for operation at under 100 psig.

NOTE: It is possible to apply to the DOT for a waiver allowing an operating pressure of 100 psig or more.

2.27.01 PLANNING

2.27.01.1 Mains

- Outline the area to be uprated on section maps or other plans that show the distribution system.

- Repair or replace badly corroded or leaking mains.

- Indicate all mains, valves, drips, purge points and other fittings which should receive individual attention before pressures are increased.

- Check all records to determine manufacturers' pressure ratings for all materials and indicate on plans.

- Indicate on plans the methods for isolating and supplying branch connections.

    - Mains that can be valved off at tees when supplied by other existing sources.

    - Mains which must be cut off and supplied by regulator/relief valve combinations which must be installed prior to increasing pressures.

2.27.01.2 Services

- Prepare a list of all service connections which will be affected by pressure elevation.

- Determine which services are active or inactive.

- Identify all services by house number in the field, record the locations of outside shutoff valves (i.e. riser valves and/or curb valves) and locate curb valves if no other outside shutoffs are available. Notify homeowner or tenant of any proposed service alterations.

- Check all records to determine manufacturers' pressure ratings for all materials and indicate on the list of services any items that should be replaced.

2.27.02 PREPARATION:

2.27.02.1 <u>Mains</u>

- Conduct a leak survey and repair any leaks found.

- Check all valves as shown on plans of the area uprate.

  - Straighten and/or raise to grade boxes as required.

  - Grease valves as necessary and operate all valves to insure proper functioning.

  - Repack all gate valves with Teflon packing at stuffing boxes.

  - Repair any deficiencies.

- Remove and/or replace any fittings or materials not suitable for elevated pressures because of low pressure ratings.

  - Gas cocks on drip risers.

  - Corporation cocks on purge points.

  - Line caps or couplings on dead end stubs.

  - Flanges and flanged fittings.

- Isolate branch main connections.

  - Valve off where possible.

  - Install regulator/relief valve combinations where a source of supply is required. Install stopper fittings, cut off mains and weld caps on main ends where valves can not be utilized. Squeeze and cut off mains and butt fuse or mechanically join caps on main ends where valves cannot be used.

- Install recording gauges to monitor operation.

- Install mains and/or equipment necessary to provide required pressures and volumes to system.

2.27.02.2 Services: (100 psig and above)

- Install a flow limiter and properly rated service valve at every service. If the maximum operating pressure of the system exceeds 125 psig or the maximum allowable operating pressure of the house regulator, whichever is less; install a regulator with an approved overprotection device upstream of the house regulator.

- Check existing regulators and meter sets for proper operation at the new inlet pressures from regulators that have been installed at the curb valve.

- Remove and replace curb valves not suitable for elevated pressures because of lower pressure ratings.

- Abandon inactive services in the uprate area according to O&M Procedure 3.36.00.

- Petition appropriate federal and state regulatory agencies for permission to operate plastic pipe at pressures of 100 psig or above.

2.27.02.3 Services: (under 100 psig)

- Where necessary, install a proper pressure-rated curb valve or excess flow valve according to O&M Procedure 3.37.00 or 3.38.00 and 3.40.00. (Install flow limiter if the service tie-in is worked on).

- Check existing regulators and meter sets for proper operation.

- Abandon inactive services in the uprate area according to O&M Procedure 3.36.00.

- Remove and replace curb valves not suitable for elevated pressures because of lower pressure ratings.

2.27.03 OPERATION:

2.27.03.1 Mains

- Notify the MDTE, in writing, at least seven (7) days before the uprate.

- Elevate pressure in increments according to D.O.T. Subpart K of 49 CFR 192. Increase pressure in either 10-psig increments or in four equal steps, whichever give the fewest steps.

- Hold pressure constant after each incremental increase and conduct leak survey over entire segment of pipeline.

- Repair all leaks found that are potentially hazardous before increasing the pressure further. Leaks determined not to be hazardous need not be repaired if the leak is monitored during the pressure increase and the leak does not become potentially dangerous.

- Maintain pressure recordings during incremental increases.

2.27.03.2 Services: (100 psig and above)

- Leak survey each service in conjunction with the leak survey performed on mains and according to O&M Procedure 2.15.00.

- Repair all leaks found that are potentially hazardous before increasing the pressure further. Leaks determined not to be hazardous need not be repaired if the leak does not become potentially dangerous.

2.27.03.3 Services: (under 100 psig)

- Leak survey each service in conjunction with the leak survey performed on mains and according to O&M Procedure 2.15.00.

- Repair all leaks found that are potentially hazardous before increasing the pressure further. Leaks determined not to be hazardous need not be repaired if the leak is monitored during the pressure increase and the leak does not become potentially dangerous.

2.28.00 CAST IRON REPLACEMENT AND ABANDONMENT PROGRAM

This procedure addresses 220 CMR 113: Operation, Maintenance, Replacement and Abandonment of Cast Iron Pipelines, Section 113.05: Replacement and Abandonment Program and Procedures. FG&E, has developed and implemented this program to evaluate the cast iron pipe to prioritize and schedule failure-prone segments for replacement or abandonment.

The regulation calls for the replacement or abandonment of all cast iron pipe with a nominal diameter of eight inches or less that is known, or has been determined, to have been installed before 1860.

2.28.01 THE PROGRAM

Certain segments of cast iron pipe are identified as *candidates* for replacement based upon certain selection criteria. These segments are based upon pipe performance, maintenance history, risk factors and other operational factors. Based on these characteristics, point values are assigned. The point values are higher for those

characteristics found to be more likely associated with a leak or break, for those characteristics associated with higher risk in the event of a leak or break, and for those characteristics associated with economic benefit to the company. Cast iron segments are ordered by descending total point value. The point value is then used to prioritize and schedule selected segments for replacement or abandonment for each of three years hence.

2.28.01.1 Selection Criteria

Each segment of cast iron pipe satisfying one or more of the following criteria is selected for further analysis:

- Its maximum actual operating pressure is greater than 1/2 psig.
- It lies underneath the roadway for which the municipality plans resurfacing or reconstruction and the pipe is 8" or less in diameter.
- It is subject to replacement due to system improvements.
- Its performance history indicates one of the following:
  - There are one or more pending leaks on the segment.
  - There have been three or more leak or break repairs made within the last four years (a rolling 12 months).
  - Its pipe diameter is a capacity restriction in the immediate area.

2.28.01.2 Prioritization of Pipe Segments

Prioritization of pipe segment replacement is done by Engineering and Operations. The prioritization is based upon ranking the pipe segments that satisfy the selection criteria.

2.28.01.3 Development of Replacement Schedule

Develop a schedule for the replacement/abandonment of specific cast iron pipe segments.

- Based on the resultant prioritization of pipe segments of cast iron for replacement.
- Assess the impact of any abnormal conditions or mechanical or chemical properties of the pipe.
- Modify the schedule to allow for sound engineering judgment. Document the rationale for the change.
- Add any segments to be replaced/abandoned due to system or municipal needs.

2.28.01.4 Administration

- Time Schedule for Replacement

  Develop a new schedule each calendar year. It is recommended that the schedule be updated in conjunction with the budgeting process. It is also suggested that the schedule be updated again in the following spring to allow for leak and break history surfacing in the winter months to be evaluated prior to the construction season.

- Annual Review of Procedures

  Review this procedure, 2.28.00, and modify accordingly at least once each calendar year or more frequently if needed.

- Record Keeping

  Maintain accurate and readily accessible records.

2.29.00 CORROSION CONTROL MONITORING AND RECORD KEEPING

2.29.01 MONITORING:

- Each cathodically protected main more than 100 feet long must be surveyed at least once each calendar year, but at intervals not exceeding 15 months, to determine if the cathodic protection meets the requirements listed below.

- Each cathodically protected service line or main under 100 feet long must be surveyed on a 10% sample basis annually, so that the entire system is surveyed every ten years.

- Each cathodic protection rectifier or other impressed current power source must be inspected 6 times annually, but at intervals not exceeding 2 ½ months, to insure that it is operating properly.

- Each reverse current switch and interference bond whose failure would jeopardize a structure must be electrically checked for proper performance 6 times annually, but at intervals not exceeding 2 ½ months. All other interference bonds must be checked at least once each calendar year, but at intervals not exceeding 15 months.

- Electrical measurements used to assure continuity of cathodic protection must meet one or more of the following criteria:

  - A minimum negative voltage of 0.85V with reference to a saturated copper-copper sulfate half cell with the protective current applied.

- A minimum negative polarization shift (decay) of 100 millivolts when the protective current is interrupted.

- A voltage at least as negative as that originally established at the beginning of the Tafel segment of the E-Long-I current.

- A net protective current from the electrolyte into the structure surface as measured by an earth current technique applied at predetermined current discharge (anodic) points of the structure.

2.29.02 REPAIRS:

- Engineering and Operations are both responsible for evaluating test results, determining what corrective action is necessary and initiating repairs. Operations will track the test date, repair action specified, date assigned and date completed for corrosion control repairs to the following:

  - Separately protected services

  - Separately protected main sections less than 100 feet long

  - Rectifiers and other impressed current power sources

  - Reverse current switches, diodes and/or interference bonds

- Repairs must be completed either before the next scheduled test or within a year of the test date, whichever comes first. Should any condition cause an immediate or imminent hazard to the public, repairs should be initiated and completed as soon as possible.

- Repairs to customer lines that "can not be shut down" will be made on the same schedule outlined above by attempting to work closely with the customer. The Company will make every effort to comply with the customer's need for continued gas service. If no mutually agreeable shutdown can be arranged, the Company will shut down the service and make repairs necessary to assure continued safe operation of the service line.

2.29.03 RECORD KEEPING:

Each of the following records must be retained for as long as the pipeline remains in service.

- Records or maps must be maintained to show the location of cathodically protected piping, cathodic protection facilities, and any foreign structures bonded to the cathodic protection system.

- Records of each test, survey, or inspection must be kept in sufficient detail to demonstrate the adequacy of the corrosion control measures, or that a corrosive condition does not exist.

- Records of repairs covered in this section under the heading REPAIRS.

2.30.00 ATMOSPHERIC CORROSION

Each above ground gas pipeline or any gas related piping system exposed to atmosphere must be inspected, at intervals not exceeding three years, to ensure it is protected with a material to prevent atmospheric corrosion.

Atmospheric corrosion is best found by visual inspection and examination. Exposed piping should be inspected for the following:

- The protective coating on the pipe should be in good condition; if not, schedule the coating for repair or replacement.

- All metallic pipe supports and restraining devices, including hangers, rollers, wear plates, etc., should be protected from corrosion. Attach protective sleeves to pipe where contact with rollers or clamps would damage the coating.

- All expansion joints and compression couplings should be properly coated and checked for gas tightness and proper operation of the expansion joint.

- Cathodically protected pipe should be electrically isolated from metallic bridge structures, pipe supports, pilings and reinforced concrete foundations. Piping may be attached directly to the bridge without insulation if insulating devices are installed at each end of the bridge.

Note results of the inspection and any recommended maintenance work on the Atmospheric Corrosion Control Survey Report form.

Record any scheduled maintenance work performed on the work order form.

2.31.00 PRECAUTIONS FOR UNSAFE GAS ACCUMULATION IN TRENCHES

These procedures are intended to protect workers when working in trenches in which unsafe accumulations of vapor or gas may exist. In trenches where an oxygen deficiency or a hazardous atmosphere could reasonably be expected, test the atmosphere in the excavation with a combustible gas indicator before entering. Employees shall use approved breathing apparatus as required. Emergency rescue equipment, such as a harness and line or a lanyard shall be readily available where hazardous atmospheric conditions may reasonably be expected to develop during work in a trench. The equipment shall be attended when in use.

2.32.00 PROCEDURE FOR INVESTIGATION OF FAILURES

2.32.01 DEFINITION:

Failure is defined as an incident that:

- Caused a death or personal injury resulting in hospitalization.
- Resulted in gas from an uncontrolled source igniting.
- Caused estimated damage to the property of the operator, or others, of a total of $50,000 or more.
- Caused interruption of supply to a section or threatened system reliability.
- Required extraordinary actions to be taken.

2.32.02 OBJECTIVE:

To determine the cause of a failure meeting the above criteria so that corrective action can be taken to minimize the possibility of a recurrence or to minimize the consequences should there be recurrence.

2.32.03 PROCEDURE:

As soon as the area has been made safe, the Manager of Gas Systems or designee shall have sufficient photographs taken to record the situation at that time. The Manager of Gas Systems or designee is responsible for taking samples for laboratory analysis, if appropriate. The Manager of Gas Systems or designee shall make sure that all required inspections and tests and their results are recorded, and shall prepare a summary report covering the incident. If the cause of the incident is not readily identifiable, the Manager of Gas Systems or designee will take care to maintain the area in as undisturbed a condition as possible until further investigation may be undertaken.

For any failure, submit a report to the Manager of Gas Systems or Director of Operations within 24 hours. The report shall consist of a description of the incident, a statement of the cause of failure, and any corrective recommendations.

2.33.00 CONFINED SPACE ENTRY

Follow these procedures when entering:

- A regulator pit which is accessed through a manhole cover,
- A LNG plant absorber/dehydrator or other equipment accessed through a manhole cover,
- A large commercial boiler for natural gas retrofit or
- Other confined areas accessed through a manhole cover.

2.33.01 PREPARATION:

- Set up work area protection in accordance with applicable Company safety standards.
- Keep all sources of ignition away from the work area.
- Take care to prevent engine exhaust from entering the confined area.
- Test for the presence of combustible gas and available oxygen with a confined space entry gas meter by using available openings.
    - If the oxygen content in the confined space is less than 19.5 percent, ventilate the confined area for five minutes and retest the confined space.
    - If combustible gas is indicated, carefully remove the cover or open the entry way and ventilate the confined area for five minutes and then retest with the combustible gas indicator.
    - If the reading on the combustible gas indicator is more than 10% of lower explosive limit, determine how gas is entering confined area.
    - If gas is entering confined area, **DO NOT** enter confined area but report leak to dispatcher for follow up. **DO NOT** enter confined area until leak is repaired.
    - If the leak is on the gas piping, force-ventilate the confined area before entering and while making repairs.
- If the reading on the combustible gas indicator is 10% of the lower explosive limit or less, the confined area may be entered provided that forced ventilation continues.
- A full body harness shall be worn by the employee entering the confined area.
- Do not place materials, tools or equipment near the confined area where they could cause tripping or other type hazards.
- Do not weld in the confined area without first obtaining approval.

2.33.02 PROCEDURE:

- At a minimum, a two-person team is required. The team is comprised of an entrant and an attendant. The sole job of the attendant is to monitor the condition of the space and the entrant inside the confined space and to terminate the entry should conditions warrant. The attendant may not enter the confined space and may not leave the monitoring role (e.g. to get a tool, answer the radio or for any other reason) for even a moment while the entrant remains inside the confined space.

- The entrant must wear a full body harness with a D-ring on the back and remain attached to a winch line, in the case of a manhole access, or a tag line held by the attendant in the case of a boiler entry. Body belts and wristlets are not allowed as substitutes for a full body harness.

- The entrant into a manhole accessed confined space must also wear all required personal protective equipment..

2.34.00 REGULATOR PERFORMANCE TEST – ANNUAL

Regulators shall be subjected, annually, to a systematic performance test to determine that they are in proper operating condition.

- Record inlet pressure.

- Record outlet pressure.

- Visually check the condition of the regulator and observe for proper functioning.

- Check the regulator for tightness:

  - On a self-operated regulator, change the setting and see if the regulator will lock off.

  - On a pilot-operated regulator, change the setting on the pilot regulator and see if the main regulator will lock off.

- Check the regulator for sticking. This can be observed from an erratic line on a pressure chart.

- Reset the regulator and see that it is at the correct operating pressure.

- Check vent and control lines for blockage.

- Clean all filter elements.

- Record the test on the proper forms.

2.35.00 INTERNAL INSPECTION OF REGULATORS AT GATE STATIONS

This procedure applies to maintenance and inspection of regulators at gate stations. Refer to and follow the manufacturer's procedures.

Each regulator shall be inspected annually to determine that it is properly installed, protected from dirt, liquids or other conditions that might prevent the proper operation of the regulator. An internal inspection shall be conducted and the necessary parts repaired or replaced. This inspection shall be conducted in accordance with the following procedure:

- Notify Dispatch of planned work.
- Monitor pressures during inspection.
- If a bypass valve exists, open as necessary to maintain outlet pressure while inspection is being made.
- Isolate the regulator by closing appropriate main line shutoff and control line valves in the appropriate sequence. Follow manufacturer's instructions for taking regulator out of service. Test to be sure the regulator has been completely isolated by opening a vent valve or, as a last resort, by disconnecting a static line before disassembling equipment.
- Remove inspection plates or disassemble regulator body on main line and control regulators to inspect gas flow restricting devices (orifices, valve discs, "O" rings, tubes, etc.) and diaphragm link for wear.
- Pressure test or visually inspect all diaphragms for tightness.
- Check regulator vent lines, all control lines, and differential control restricting devices (needle valves, adjustable variable orifices, etc.) for stoppage.
- Reassemble regulator.
- Pressure test regulator for leakage.
- Follow manufacturer's instructions for putting regulator into service. Open appropriate control lines and main line valves in the appropriate sequence.
- Set regulator to desired pressure.
- If bypass exists, close valve.
- Check regulator setting to function at the correct operating pressure:
- Self-operated regulator – change setting on pilot regulator and see if main regulator will follow change and lock off.
- Reset regulator to desired operating pressure.
- Notify Dispatch at completion of inspection.
- Note results of inspection and work performed on the appropriate forms.

2.36.00 INTERNAL REGULATOR INSPECTION (REGULATOR STATIONS)

Each regulator shall be inspected every five years to determine that it is properly installed, protected from dirt, liquids or other conditions that might prevent the proper operation of the regulator. An internal inspection shall be conducted and the necessary parts repaired or replaced. This inspection shall be conducted in accordance with the following procedure:

- Notify dispatch of planned work.
- Monitor pressures during inspection.
- If a bypass valve exists, open as necessary to maintain outlet pressure while inspection is being made.
- Isolate the regulator by closing appropriate main line shutoff and control line valves in the appropriate sequence. Follow manufacturer's instructions for taking regulator out of service. Test to be sure the regulator has been completely isolated by opening a vent valve or, as a last resort, by disconnecting a static line before disassembling equipment.
- Remove inspection plates or disassemble regulator body on main line and control regulators to inspect gas flow restricting devices (orifices, valve discs, "O" rings, tubes, etc.) and diaphragm link for wear.
- Pressure test or visually inspect all diaphragms for tightness.
- Check regulator vent lines, all control lines and differential control restricting devices (needle valves, adjustable variable orifices, etc.) for stoppage.
- Reassemble regulator.
- Pressure test regulator for leakage.
- Follow manufacturer's instructions for putting regulator into service. Open appropriate control lines and main line valves in the appropriate sequence.
- Set regulator to desired pressure.
- If bypass exists, close valve.
- Check regulator setting to function at the correct operating pressure.
    - Self-operated regulator - change spring setting and see if regulator will follow change and lock off.

- Pilot-operated regulator – change setting on pilot regulator and see if main regulator will follow change and lock off.

- Reset regulator to desired operating pressure.

- Notify Dispatch at completion of inspection.

- Note results of inspection and work performed on the appropriate forms.

2.37.00 RELIEF VALVE INSPECTION AND TESTING – ANNUAL

Each relief valve shall be subjected to a systematic inspection and test annually, in accordance with the following procedure.

The inspection shall consist of a check to insure that the relief valve is:

- In good mechanical condition.

- Set to function at the correct pressure.

- Adequate from the standpoint of capacity and reliability of operation for the service in which it is employed. (See Item III)

- Properly installed and protected from dirt, liquids or other conditions that might prevent proper operation.

The test, if feasible, shall consist of the following:

- Check records for pressure at which valve should relieve.

- Isolate the relief valve from the system it is designed to protect. In most cases, this can be done by unlocking and closing the valve ahead of the relief valve.

- Connect a temporary line from a pressure supply to the piping between the relief valve and the now closed valve ahead of it. This pressure supply may be existing gas pressure before a regulator, an air tank, a nitrogen bottle or other device with a pressure greater than the relief pressure. This temporary line should have a pressure gauge on it.

- Turn on the pressure supply and operate the relief valve. Take note of the pressure at which the valve relieves. Any serious deviation from the desired relief pressure should be corrected.

- Shut off the supply pressure and observe the gauge still hooked into the piping before the relief valve. A constant pressure reading on the gauge indicates a positive seal on the relief valve.

- Disconnect the supply line from the relief valve piping and close off the outlet in piping.

- Open the valve ahead of the relief valve and lock, or tag, with warning to prevent change of position.

The test, if not feasible, shall consist of the following:

- Recalculation of the required capacity of the relieving device at each station must be made at intervals not exceeding 15 months but at least once each calendar year and these required capacities compared with the rated or experimentally determined relieving capacity of the device for the operating conditions under which it works. After initial calculations, subsequent calculations are not required if the review documents that parameters have not changed in a manner that would cause the capacity to be less than required. If the relieving device is of insufficient capacity, a new or additional device must be installed to provide the additional capacity required.

A record of the inspection, test or relocation, and all changes or repairs shall be completed and turned into the appropriate department where it will be maintained for the life of the device.

2.38.00 INSTALLATION OF FITTINGS AND TAPPING A METALLIC MAIN

2.38.01 SELF TAPPING TEE ON STEEL MAIN

- Expose the main and prepare it for the connection.

- Fabricate stub using self-tapping tee and appropriate device.

- Extract cutter from tapping tee before positioning the tee on main and welding. Make sure it is greased.

- Place a fire extinguisher near the work area where it will be accessible for immediate use.

- Weld the tee on the main and allow it to cool. DO NOT COOL WITH WATER.

- Pressure test before tapping.

- Tap the main according to manufacturer's instructions.

- When tap is completed, run tap up and down again to prevent flapper valve action that would shut off gas.

- Install cap on tee wrench tight.

- When installing a service on older mains, use care when tapping. The older pipe could be heavy wall pipe.

- Install a 3-pound magnesium anode on the non-insulated portion of the tapping tee attached to the main. Clean and coat any fitting or portion of any fitting without a factory applied corrosion preventive coating.

2.38.02 LINE STOPPER OR EXTENSION STOPPER FITTING ON STEEL MAIN

- Expose the main and prepare it for the connection.

- Place a fire extinguisher near the work area where it will be accessible for immediate use.

- Weld the fitting on the main and allow it to cool. DO NOT COOL WITH WATER.

- Pressure test stub to at least 100 psi. Test for leaks using liquid soap.

- Install the gate valve in the open position on the fitting. Test alignment of completion plug.

- Put correct size cutter in tapping machine and grease the cutter.

- Install tapping machine on gate valve wrench tight.

- Tap the main using a slow, steady feed rate.

- Raise cutter handle carefully (pressure from main will try to force the shaft up) and CLOSE the gate valve.

- Remove tapping machine.

- Remove the cutter and install the inserting tool and the completion plug on the machine.

- Re-install machine on the gate valve wrench tight. Pull handle to uppermost position and lock before opening the gate valve.

- Open the gate valve and seat the completion plug in the fitting, using care when starting the threaded plug. A non-drying thread compound should be used on the plug.

- When the completion plug is tight, reverse the ratchet and give it a sharp tap in a counter-clockwise direction to break the inserting tool loose. Continue turning and unscrew the tool.

- Pull up the handle and lock.

- Remove tapping machine, bleeding pressure before completed removal. Check completion plug for proper seating.

- Remove the gate valve.

- Tighten the completion plug with completion plug wrench.

- Install cap and tighten. Soap test and apply protective coating.

- Install a 3-pound magnesium anode on the non-insulated portion of the fitting attached to the main. Clean and coat any fitting or portion of any fitting without a factory applied corrosion preventive coating.

2.38.03 LATERAL OR SERVICE TAPS OFF OF CAST IRON MAINS

- Mains 6 inches or less in diameter:

  - Place a fire extinguisher near the work area where it will be accessible for immediate use.

  - Expose the main and prepare for connection. The cast iron should be well cleaned in the area where the reinforcing fitting will be installed.

  - Install correct cutter in machine. Tap is to be no larger than ¼" per 1" diameter of pipe. (Exception: a 1-1/4" tap is allowed in a 4" standard pipe).

  - Install machine and drill main using moderate pressure.

  - Remove machine.

  - Install insulated street tee and complete the service.

  - Test for leaks with liquid soap.

  - All taps made on cast iron mains 6" or less shall have full encirclement reinforcement.

  - Install a 3-pound magnesium anode on the non-insulated portion of the fitting attached to the main. Clean and coat any fitting or portion of any fitting without a factory applied corrosion preventive coating.

- Mains greater than 6 inches in diameter:

  - Place a fire extinguisher near the work area where it will be accessible for immediate use.

  - Expose the main and prepare for connection. The cast iron should be well cleaned in the area of the connection.

- Install correct sized cutter and tap in the low pressure tapping machine and grease cutting threads as well.

- Install low pressure tapping machine squarely on the main and tighten machine down snugly.

- Feed cutter at an even rate and operate ratchet to drill main.

- Start tap in main and then back off on drill feed rod. Continue tapping the main. Special care should be taken not to allow the tap to be run too far into the main as an oversized thread may be cut.

- Unscrew the tap and cutter.

- Remove tapping machine, install an insulated street tee and complete the service.

- Test for leaks with liquid soap.

- Install a 3-pound magnesium anode on the non-insulated portion of the fitting attached to the main. Clean and coat any fitting or portion of any fitting without a factory applied corrosion preventive coating.

2.39.00 QUALIFICATION OF PLASTIC PIPE INSTALLERS

2.39.01 PURPOSE:

This section prescribes the tests that shall be used to qualify Company or Contractor employees who join plastic pipe. [REF CFR 49 192.271-192.287]

2.39.02 TEST REQUIREMENTS FOR QUALIFICATION:

The following qualifications shall be utilized to meet the criteria for Company or Contractor employees who will be joining plastic pipe by fusion or mechanical fittings.

- The North East Gas Association (N.G.A.) will be the qualifying agency.

- Before any individual performs any pipe joining of plastic gas mains and services, the individual must become qualified under the applicable written joining procedure.

- A knowledge test, comprising of a written examination, is required to ensure a minimum understanding of plastic joining procedures and techniques. The minimum passing score for the test is 80%.

- A performance test based; the individual will submit specimen joints for each applicable joining procedure.

- An N.G.A. instructor will observe the joining processes to ensure that the proper joining procedures are being followed.

- The N.G.A. instructor will visually examine each joint made during and after the fusion. The instructor will determine if the joints have the same appearance as joints or photographs of joints that are acceptable under the procedure.

- If the specimen passes the visual inspection each joint will be cut into at least 3 longitudinal straps. Each strap must be visually examined and found not to contain voids or discontinuities on the cut surface of the joint area. Each strap must be deformed by bending, torque or impact. If failure occurs, it must not initiate in the joint area.

- A qualification card will be given to each individual who satisfactorily makes acceptable joints by following various fusion procedures.

- Each individual must be requalified once each calendar year or if during any 12 month period that person:

    1. Does not make any joints under that procedure; or

    2. Has 3 joints or 3% of the joints made, whichever is greater, under that procedure that are found unacceptable by pressure testing.

2.39.03 PLASTIC FUSION INCLUDING ELECTROFUSION:

1. A person qualifying to these requirements shall make the following joints:
2. A butt fusion joint from two segments of two-inch or three-inch pipe.
3. A socket fusion joint out of two segments of two-inch diameter pipe.
4. A typical service line connection to a plastic pipeline (e.g. saddle or sidewall fusion) by fusing the fitting to a two-inch diameter plastic pipe segment. This connection shall be made in approximately the same position as it would be made in the field.
5. The person shall prepare a segment of two-inch pipe for electrofusion in accordance with the manufacturer's qualified procedure and make a fused joint with and electrofusion coupling. Two people may be qualified for electrofusion using the same coupling, provided each person prepares one pipe segment. Improper preparation shall be cause for rejection.

2.39.04 TESTING OF FUSION JOINTS FOR QUALIFICATIONS

1. For the testing of joints, a visual inspection of the completed joint shall be made to determine that it has the same appearance as a physical joint, or photographs of a joint, that is acceptable under the qualified joining procedure. Except for saddle fusion joints, the segments joined shall be cut into three longitudinal straps approximately one inch wide, measured on the outside circumference, and having eight inches of pipe on either side of the joints. For saddle fusion joints, one sample

strap shall be cut from the center of the fitting, and the remaining two sample straps shall be cut from each side of the center strap. Each strap shall be:

2. Visually examined and found not to contain voids or discontinuities on the cut surfaces of the joint area; and
3. Bent in a root bend mode for butt fusion to an included angle of 60 deg or less, and found not to have failed in the joint area.

2.39.05 MECHANICAL FITTINGS FOR PLASTIC PIPE:

Each person using mechanical fittings to make joints in plastic pipelines shall be qualified in accordance with a written qualified joining procedure for each type of mechanical fitting used by the company. A sample joint shall be made for examination. The term "type refers to a fitting in common usage which is made up by different principles (e.g. torquing, bolting, crimping, or hydraulics). This includes, but is not limited to compression couplings, stab fittings, basement tees, and mechanical service line saddle tees.

2.39.06 EMPTY - FOR FUTURE USE

2.39.07 EMPTY - FOR FUTURE USE

2.39.08 EMPTY - FOR FUTURE USE

2.39.09 EMPTY - FOR FUTURE USE

2.39.10 EMPTY - FOR FUTURE USE

2.39.10 ACCEPTABILITY OF TEST JOINTS

2.39.11 FUSION JOINTS

1. For the testing of joints, a visual inspection of the completed joint shall be made to determine that it has the same appearance as a physical joint, or photographs of a joint, that is acceptable under the qualified joining procedure. Except for saddle fusion joints, the segments joined shall be cut into three longitudinal straps approximately one inch wide, measured on the outside circumference, and having eight inches of pipe on either side of the joints. For saddle fusion joints, one sample strap shall be cut from the center of the fitting, and the remaining two sample straps shall be cut from each side of the center strap. Each strap shall be:
2. Visually examined and found not to contain voids or discontinuities on the cut surfaces of the joint area; and
3. Bent in a root bend mode for butt fusion to an included angle of 60 deg or less, and found not to have failed in the joint area.

2.39.12 MECHANICAL FITTINGS

Each joint made by use of a mechanical fitting shall be visually examined during and after assembly or joining and found to be assembled or joined in accordance with the manufacturer's qualified written procedure.

2.39.13 EMPTY – FOR FUTURE USE

2.39.14 REQUALIFICATION:

A person shall be re-qualified under an applicable procedure if, during any 12 month period, that person:

1. Does not make any joints under that procedure; or
2. Has made three or more joints under an applicable joining procedure that are found unacceptable by visual examination or pressure testing.

2.40.00 CASINGS

Pipe casings were originally designed to provide a conduit for installing or removing pipe from underneath roadways and to shield the underground carrier pipe from road traffic vibrations.

2.40.01 CASING INSULATORS:

- The carrier pipe shall be electrically isolated from metallic casings that are a part of the underground system

- The carrier pipe coating in the section to be cased, shall be thoroughly inspected with a Holiday Detector, and coating repairs made prior to installing the insulators. (See O&M Procedures 3.48.00 and 3.49.00).

- Casing insulators shall be installed on the carrier pipe for all designed cased crossings and on insertions of a smaller pipe in existing old pipelines.

- A full insulator within one foot of each end of the casing is recommended.

- Type of insulator and maximum spacing on the carrier pipe is dependent upon the pipe size and operating conditions. If the casing is bent or pipe deflection is anticipated, reduce spacing as necessary. (See O&M Procedure 3.21.00 for insulator spacing on normal crossing.).

- All insulators must be firmly bolted around pipe.

- Insulators with heavy duty or reinforced skid bars, designed to withstand severe abrasion, are recommended when pipe is pushed into long cased crossings.

2.40.02 CASING END SEAL:

- Carrier-casing seals are used to restrict water and debris from entering the casing. Seals should be flexible and allow for lateral movement of the pipe.

2.40.03 ELECTRICAL TEST:

- The casing-to-pipe resistance or other comparable test, should be made prior to the final tie-in on new construction, to confirm that the casing is electrically insulated from the carrier pipe.

- Install a type "D" cathodic test station during all new steel casing installations. (See O&M Procedure 3.29.00 – Type 2 Test Station at Foreign Structures).

- A check of the casing-to-pipe resistance will be made on the annual corrosion control survey whenever test stations exist.

2.40.04 CASING PIPE:

- The recommended casing pipe size and wall thickness is noted in O&M Procedure 3.21.01.

- When installing split-casings on existing pipelines, take precautionary measures to insure the welding operation does not damage the pipe coating or insulators.

2.40.05 REMEDIAL ACTION FOR SHORTED PIPE:

Where there is an indication on existing installations that corrosion is occurring on the carrier pipe or where a cathodic protection installation is rendered inadequate as a result of low resistance between the casing and carrier pipe, practical measures to help insure adequate corrosion protection on the pipeline may consist of one or more of the following:

- Filling the annular space between the carrier pipe and casing with a non-conductive filler.

- Applying cathodic protection to the carrier pipe.

- In some cases where the carrier pipe is shorted to the casing near the end of the casing, it may be practical to expose the ends of the casing and physically lift the carrier and/or casing pipe to give the proper clearance for inserting electric insulating material in sheet form between the carrier and casing pipe.

2.41.00 <u>EMPTY - FOR FUTURE USE</u>

2.42.00 PROCEDURE FOR HANDLING STATIC ELECTRICITY WHEN INSTALLING AND REPAIRING PLASTIC PIPE

Although plastic piping is not a conductor of electricity, it is susceptible to induced static charges which may be collected by the piping as a result of handling or from internal friction and turbulence within the piping. Whenever a charged pipe is placed in contact with a foreign object, it is possible to discharge in the form of a spark. For this reason it is most important to provide a ground path for these charges whenever making repairs, tie-ins or handling pipe in situations where live gas could be present. A ground path can be provided by doing the following:

- Douse or spray water on the ground near the place where you will be working.
- Prepare a static grounding kit for use. A static grounding kit consists of a half-gallon container filled with soapy water (or a soapy antifreeze solution when used in cold temperatures), a thirty-foot long roll of cloth tape and a combination brass ground rod and cap.
- Saturate the cloth tape.
- Drape the saturated cloth from the ground towards the area where you intend to work.
- Spiral wrap the cloth tape around the piping at least three or four turns on each side of the work area leaving approximately eight inches between loops.
- Be sure that the cloth tape around the tie-in or cutout site is out of the work area.
- Insert the brass ground rod into the ground in a wet area.
- Keep the cloth tape moist for the duration of the job.
- When the job has been completed, remove and clean the tape before re-rolling and returning to the container. Water or antifreeze solution must be added to assure that sufficient fluid is available for the next time it is used.

2.43.00 PIPE LOCATOR

2.43.01 GENERAL:

- The pipe locator is a portable battery operated electronic instrument for detecting and accurately locating buried metal pipes.
- The instrument consists of two units, a directional radio-type transmitter and a receiver. The function of the transmitter is to induce on the buried pipe an electro-magnetic field. The receiver locates the pipe by tracing the electro-magnetic field.

- The inductive method is most commonly used whereby the magnetic field is created by transmission through both soil and air. For the conductive method the transmitter is connected directly through an electrical contact to a known or exposed portion of the pipe sought, such as a service, drip or valve.

- The conductive method is used when other metal facilities are present in the area which might tend to distort the signal and result in an incorrect conclusion. When using either method, if the pipe being traced is in contact with another pipe or wire, the electro-magnetic field will also travel on this object.

- Both instruments may be coupled by means of a handle bar for one-man operation. This arrangement may be used for locating underground pipes and street boxes.

- The pipe locator is a sensitive and expensive instrument. Do not attempt to repair it in the field.

2.43.02 INSTRUCTIONS:

2.43.02.1 Inductive Method

- Set for inductive operation.

- Place the transmitter and receiver vertically in a straight line a minimum of thirty feet apart – in a location removed from any buried pipes or wire.

- A strong signal should now be received in the headphone and on the meter in the receiver when the instruments are in a straight line. While keeping the instrument away from the supposed location of the pipe being sought, adjust the sensitivity dial on the receiver until the signal can just be heard and the meter reading approaches zero.

- Keeping the instrument in the same relative position and in a line approximately parallel to the pipe to be located, move the transmitter and receiver slowly across the presumed location. A maximum increase in tone and a visible rise of the indicator needle on the receiver will occur simultaneously when both parts of the instruments are directly over the desired pipe. See Figure 1 on page 54.

- To pinpoint the center of the pipe, stand the transmitter upright, parallel with, approximately over and in line with the pipe. Hold the receiver in a horizontal position over the pipe at least thirty feet from the transmitter. Move the receiver slowly back and forth over the suspected location. Keep the transmitter and the receiver at approximately the same height. The operator will observe a distinct minimum signal or null when the receiver is directly over the pipe. See Figure 2 on page 54.

- Once a definite location of any part of the main or service has been located, set the transmitter over the known facility with the broad side of the transmitter in a

straight line with the pipe. Connections or extensions may then be traced with the receiver by following the maximum signal when the broad side of the receiver is moved at right angles to the line of the unlocated connected pipe. See Figure 3 on page 55.

- One must exercise caution at all times where insulating joints have been installed in the system because the signal will decrease after passing this point.

2.43.02.2 Conductive Method:

- Set the transmitter on the ground near a known facility connected to the pipe being traced, such as a valve, drip, service, etc.
- Attach one end of a wire connector to the known facility and attach the other end to the pipe cable connection on the transmitter.
- Attach one end of a wire connector to a metal ground plate, pipe or similar object laid on or inserted into the ground. Attach the other end to the ground plate connection on the transmitter. See Figure 4 on page 55.
- Set conductive-inductive switch to conductive position. Pull out the power switch and plug in the headphone on the receiver.
- Adjust the sensitivity dial on the receiver until the signal can just be heard.
- Hold the receiver in a vertical position at least thirty feet from the transmitter. Observe the increase in the tone and visible rise in the indicator needle occurring simultaneously when the receiver passes over the desired pipe location.

2.43.02.3 Handle Bar Method

For locating metal facilities, such as valve or drip covers, it may be advantageous to couple the transmitter and receiver by using the handle supplied.

- Attach the handle as shown in Figure 5 on page 56. Plug the headphones into the receiver. Adjust the sensitivity control. Set inductive-conductive switch to inductive position.
- Adjust the instrument to a null position.
- A sharp increase in tone and meter reading will be observed when the receiver passes over a metal object. If the instrument appears overly sensitive, slightly reduce the setting of the sensitivity control.
- Stay away from cars or other metal objects when adjusting the instrument.

2.43.02.4 Finding Depth of Main or Service, Figure 6:

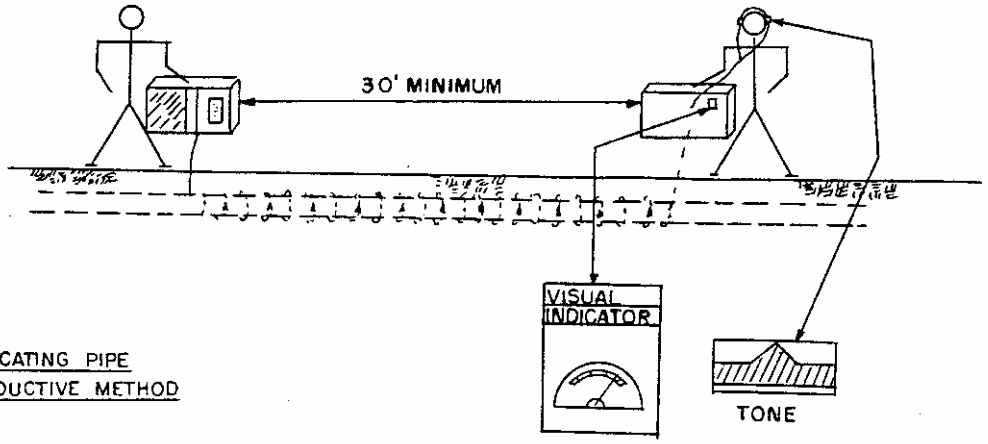
- Most pipe locator receivers have a level built into the face. This level can be used to find the depth of a main or service that has been pinpointed.

- After pinpointing the pipe, keep the receiver flat, then tilt until the level is centered (should be 45°). Move the receiver to left or right until null is heard. The distance in a straight line to the original null less the distance from receiver to ground is the depth of the pipe.

2.43.02.5 Locating Mains and Non-Metallic Pipes with Aid of Metal Snake

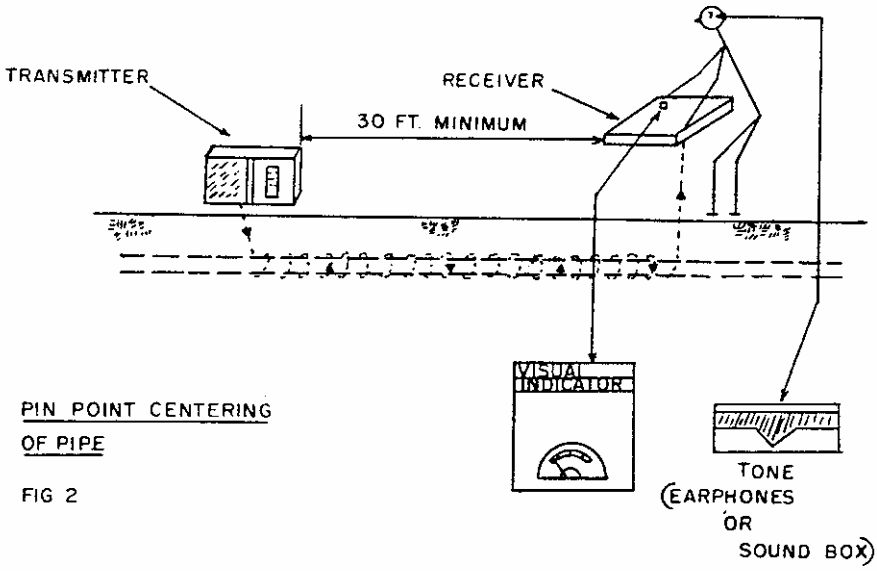
- In certain cases the pipe locator may be used to advantage in locating low-pressure mains where insulating joints make tracing through normal procedures difficult.

- Make an excavation over a known location of the low pressure main. Tap a hole and insert a metal snake to the point where the location of main is desired. Use the pipe locator to trace snake using either the conductive or inductive method.



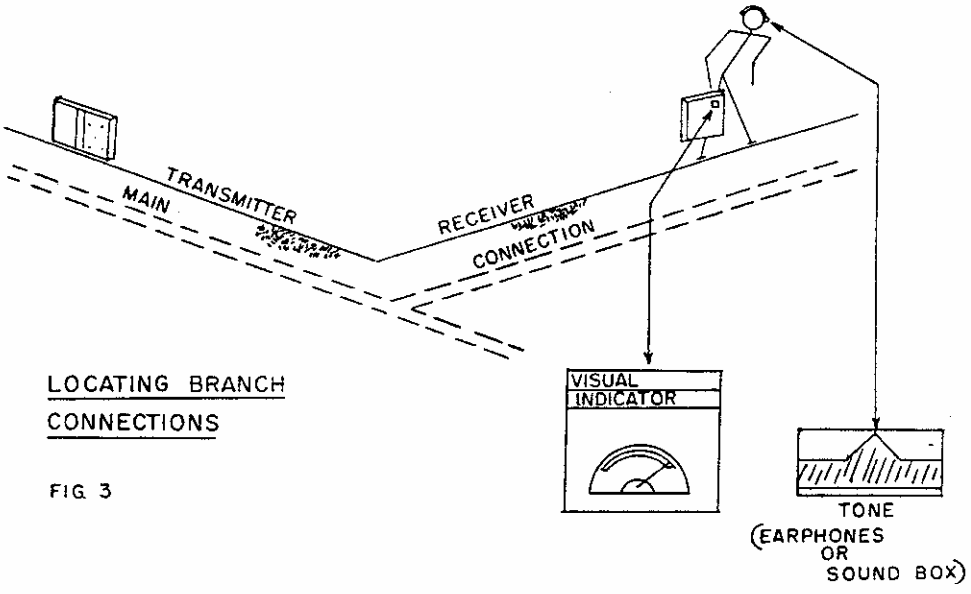
LOCATING PIPE
INDUCTIVE METHOD

FIG. 1



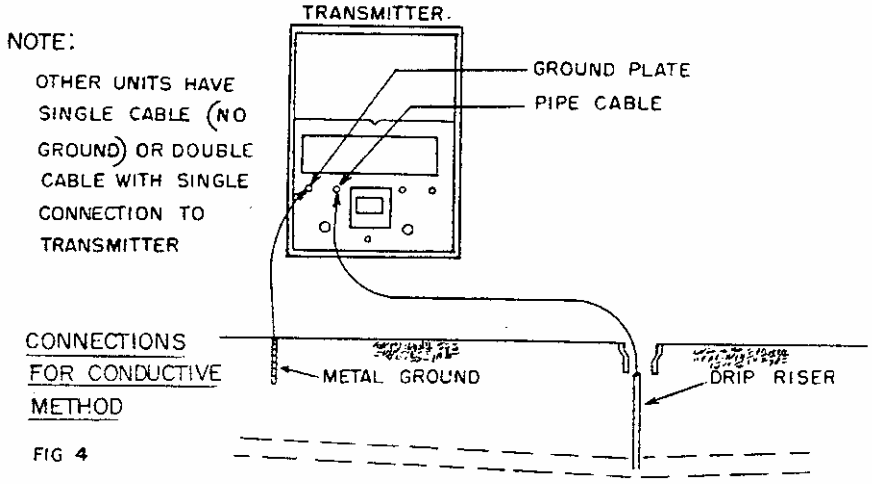
PIN POINT CENTERING
OF PIPE

FIG 2



LOCATING BRANCH CONNECTIONS

FIG 3

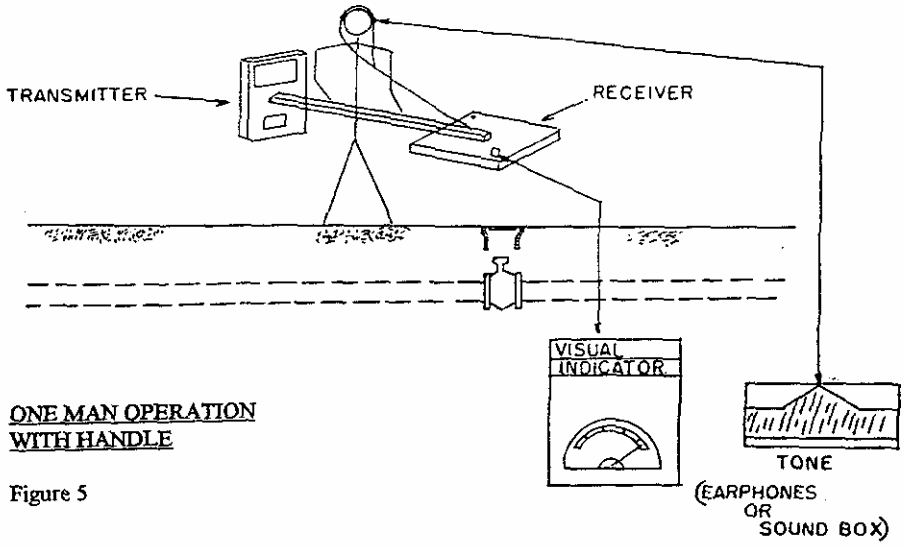


NOTE:

OTHER UNITS HAVE SINGLE CABLE (NO GROUND) OR DOUBLE CABLE WITH SINGLE CONNECTION TO TRANSMITTER

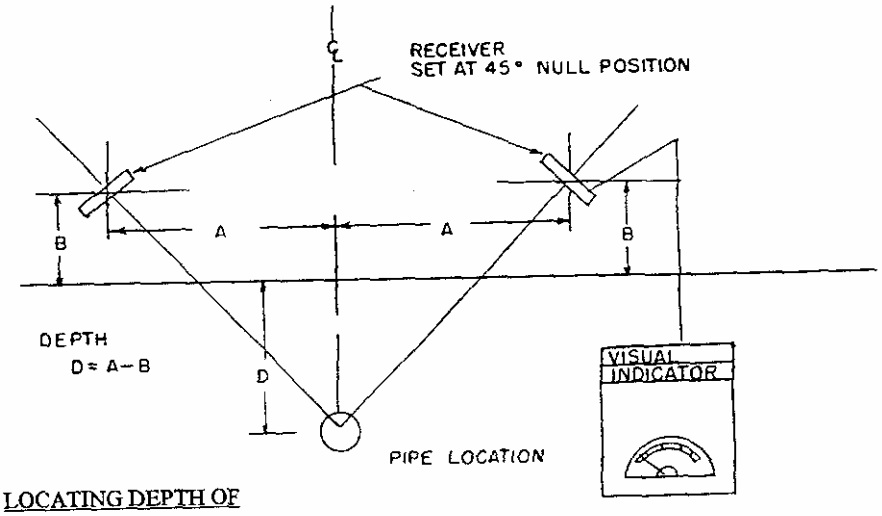
CONNECTIONS FOR CONDUCTIVE METHOD

FIG 4



ONE MAN OPERATION WITH HANDLE

Figure 5



LOCATING DEPTH OF PIPE

Figure 6

2.44.00 PHONE-TYPE INSULATING JOINT TESTER

- The phone type insulating joint tester is a simple, compact device for use in checking insulating joints of all types commonly used in gas piping systems. It consists of a very sensitive, high fidelity transducer mounted in a headset earphone which, when activated by low voltage existing on all pipe in the ground, produces an audible signal to indicate that the insulating joint being checked is effective. No outside power source is used, no complex connection are required and no involved computations are necessary to determine immediately whether the insulating joint is effective.

- This instrument is used by placing the earphone in place and applying test probes to bare pipe on opposite sides of the insulating joint. Paint and coating must be removed to insure good contact.

- If the insulating joint being checked is good and properly insulating, a clear signal will be heard in the earphone. In the case of AC, the signal will be a distinct buzzing similar to the dial tone heard in a telephone. In the case of DC, scratching the pipe with the probes will produce a click in the receiver.

- If the insulating joint is defective, no signal will be heard.

- The sensitive transducer in the instrument is activated by minute voltage. If used where more than 10 volts may be encountered, a very objectionable signal will be produced and the instrument may be damaged.

- Instructions for the testing of insulating joints.

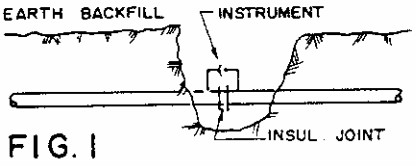


FIG. 1

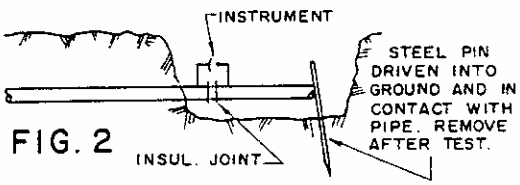


FIG. 2

- Since the instrument operates by picking up stray AD or DC current across an insulator, which enters from the ground on our pipeline, it is essential that the insulator has pipe on both ends that are well grounded (as shown in Figure 1 or Figure 2).
- Push needles firmly into pipe on opposite sides of the insulator. If the insulator is good, a distinct buzzing signal will be heard which is similar to a telephone dial tone. When the insulator is defective, no signal or a very faint signal will be heard. If the insulator is defective, disassemble and inspect the components to determine the cause of the "short".

- When insulating joints are close together, as in Figure 3, it may be necessary to "short-out" the other insulators temporarily with a file, knife, bonding wire, etc. to receive a good tone.

NOTE: Usually it is not necessary to "short-out" A & B to check C or B to check A. However, there may be some instances when this must be done.

- If it is suspected that the instrument is inoperative, a quick check with an ordinary flashlight battery, as shown in Figure 4, should produce a loud snapping noise through the earphone. This indicates that the instrument is okay.

2.45.00 PROCEDURE FOR INSTALLING MECHANICAL FITTINGS

Procedures for installing mechanical fittings currently used in Unitil-FG&E can be found in the manufacturers' manual for installation of these fittings. Also attached to each fitting is an installation guide.

2.46.00 DETERMINING PIPELINE STRAIN FROM SOIL DISPLACEMENT*

Use these procedures in conjunction with O&M Procedure 3.19.00 or another approved method. The following method applies to 4", 6" and 8" diameter cast iron pipe only.

Determining pipe strain on cast iron pipe involves three steps:

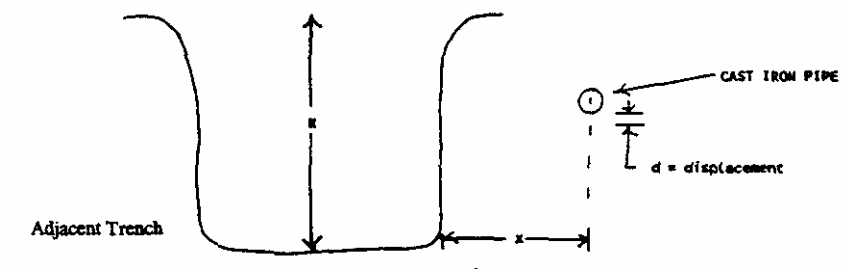
- Estimating maximum soil displacement based on soil conditions, excavation depth and location.
- Determining maximum pipeline strain from soil displacement.
- Observing field conditions during construction to check assumptions.

Step 1 – Estimating Soil displacement

Refer to Figure 1 of this Procedure to determine soil displacement. First determine:

- the depth of the adjacent trench, H.
- the horizontal distance from the edge of the excavation to the centerline of the parallel cast iron main, X.
- the soil type, and classify as Zone A or Zone B – refer to "Soil Types" below to classify soil types.

- the depth of the water table.



Once these items are determined, refer to Figure 1. Calculate the ratio x/H and read the value of d/H (this ratio is a percentage) along the proper soil zone curve. From d/H, determine the displacement, being sure to convert to inches. If there is or will be soil stockpiled on the side of the excavation or exceptionally heavy surcharges present, multiply the displacement by 1.5.

1 Adopted from a study done in 1984 by Professor T.D. O'Rourke of Cornell University for the New York Gas Group entitled Manual for Assessing the Influence of Excavations on Parallel Cast Iron Gas Mains.

Surcharges – Six wheel dump trucks, backhoes and gradalls do not constitute exceptionally heavy surcharges. Soil placed at heights exceeding 4 feet, large cranes, and any construction vehicle exceeding 30,000 lbs. in total dead weight does constitute an exceptionally heavy surcharge. If it is located within a distance equal to half the depth of the excavation of the sheeting line or edge of trench, multiply the displacement by 1.5 as described above.

Step 2 – Determining the Strain from Displacement

- Refer to Figure 2 of this Procedure. Locate the soil displacement on the x-axis. Read the bending strain along the y-axis corresponding to the proper diameter pipe. Note: this strain value represents both the vertical and horizontal bending strain.

- To obtain the total bending strain, multiply the value from Figure 2 obtained in Step 1 above by the value 1.41.

- If the total bending strain exceeds 500 microstrain, replace the pipe.

Step 3 – Observing Field conditions During Construction

- Steps 1 and 2 assume that the third party exercises good workmanship when working around cast iron facilities. If two or more of the following apply, re-evaluate the potential for excessive displacement of the cast iron pipe:

    - Large gaps and spaces along sheeting line
    - Voids behind the sheeting
    - Lack of toe support for sheeting

- Obvious local distortion of sheeting, braces or wales
- Haphazard backfilling or backfill not properly compacted
- Poor quality backfill (debris, rocks, timber, etc. or clay backfill which is not compacted carefully)

- *During third party construction, visit the site periodically to re-evaluate the conditions and assumptions on which the pipeline strain was determined. If the conditions or assumptions have changed, re-calculate the pipeline strain if initial calculations showed the strain to be less than 500 microstrain.*

- The ground water level can affect soil movement in the sidewalls of a trench. During excavation, if the trench is below the ground water level, the trench should be dewatered in a means to provide suitable control of ground movement. If the water table is above the trench bottom and the trench is not dewatered suitably, consider replacement of the cast iron pipe.

For examples, refer to the Cornell Study

Notes: 1. Zones based on field observations for average to good workmanship.

2. If soil will be stockpiled on side of excavation or an exceptionally heavy surcharge from construction equipment will be present, then multiply displacements of Zone A by 1.5.

3. Distance is from edge of the excavation to the centerline of a parallel main.

4. Water table may be lowered temporarily by dewatering with well points and deep wells outside the excavation, in which case the lower water table applies.

Chart for Estimating Soil Movement Adjacent to Deep Trench Construction

FIGURE 2

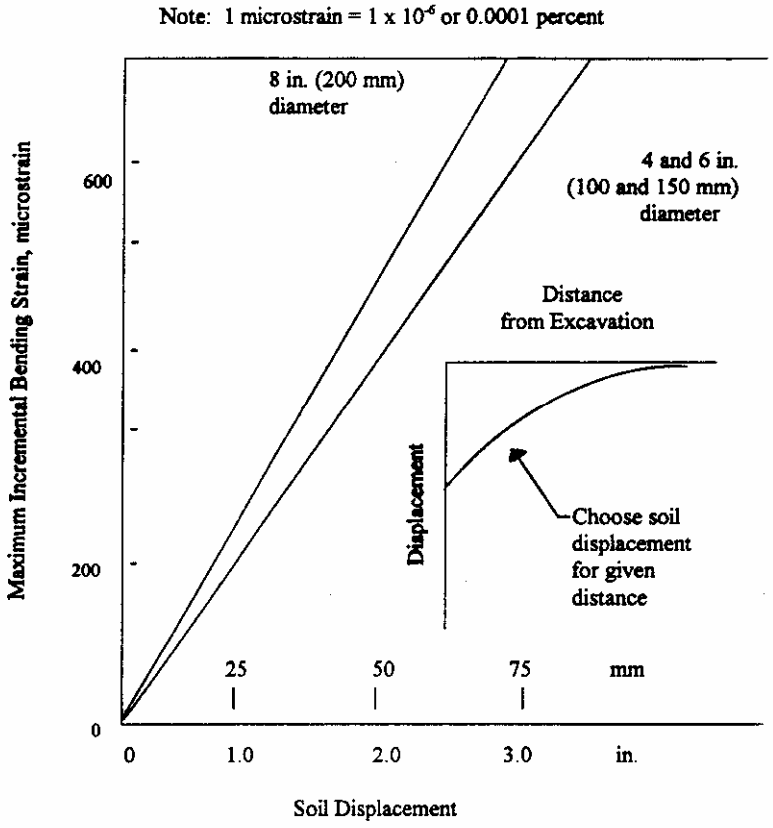


Chart for Determining Pipeline Strain from Soil Displacement.

2.47.00 PIPE CONDITION REPORT

2.47.01 GENERAL:

A buried pipeline exposed for any reason shall be examined for evidence of external corrosion and to check the condition of the pipe coating, if any.

Information concerning the pipe coating condition is important when designing a cathodic protection system or evaluating a specific coating.

Note all applicable information concerning the pipe and coating condition on the Work Order Form assigned to the job.

2.47.02 PIPE COATING INSPECTION:

Visually check the pipe coating for coating type, general condition, and rust or pitting evident at coating holidays. If the coating is removed, check for bond and evidence of moisture under the coating..

2.47.03 PIPE INSPECTION:

- If the pipe is bare or poorly coated, the pipe should be cleaned thoroughly and checked for evidence of corrosion.

- Check cast iron pipe for graphitic corrosion. This type of corrosion is attributed to the iron being selectively dissolved, leaving a porous mass consisting largely of graphite. The material remaining may appear intact but is relatively soft, and may be scraped or indented easily with a sharp instrument.

2.47.04 REPORTING:

- Record the condition of the exposed pipe on the Work Order Form. Use the following words:

  GOOD condition (no sign of wear or aging)

  FAIR condition (serviceable pipe, slight wear or aging noticeable)

  POOR condition (considerable wear and aging noticeable)

  VERY POOR condition (severe deterioration of the pipe, any graphitized cast iron)

- Any pipe determined to be in very poor condition must be reported to the Manager of Gas Systems for review within 24 hours.

- Record the data on number of corrosion pits, range of the pit depths, and pit diameters.

- Note any conditions that may have an adverse effect of the pipe or coating, such as: Contaminants in the backfill material; rock damage to the pipe or coating; and proximity to foreign pipeline crossings.

- If columns are not provided on the Work Order Form to describe all the irregularities found, enter these under the "comments" section.

2.47.05 PIPE REPAIRS:

At corrosion leak sites on coated or bare steel pipe, apply a coating to the repair fitting and to the pipe adjacent to the fitting. Install a 17-pound magnesium anode.

2.47.06 BELL JOINT SEALING:

Any time a caulked cast iron bell and spigot joint is exposed for any reason, the bell and spigot joint must be sealed by encapsulation or anaerobic seal.

2.48.00 ODORIZATION VERIFICATION PROCEDURE

Combustible gas in a distribution line must contain a natural odorant or be odorized. The gas must have a distinctive odor of sufficient intensity so that concentrations of 0.15 percent gas in air in distribution systems are readily perceptible to people with normal sense of smell.

Odorant concentration tests must be conducted periodically throughout the month at various points in the gas distribution systems.

Test points must be remotely located from the odorizing equipment so as to provide data representative of gas at all points in the system. The Manager of Gas Systems will select appropriate test points.

Concentration tests must be performed according to the odorant tester instructions provided by the manufacturer.

Technicians who conduct the concentration tests must keep records to substantiate compliance with this procedure.

2.49.00 WELDING PROCEDURES

All welding must be done by welders qualified and certified according to Company Welding Procedures. Each welder must weld according to Company Welding Procedures.
Company Welding Procedures are written in accordance with API Standard 1104 – Standard for Welding Pipelines and Related Facilities and Part 192 Subpart E of the Federal Pipeline Safety Regulations.

Copies of the Company Welding Procedures, API 1104, and the DOT Federal Pipeline Safety Regulations are kept on file by the Manager of Gas Systems.

2.50.0 OIL TANK DECOMMISSIONING PROCEDURE FOR CONVERSION BURNER INSTALLATIONS

- Locate the oil tank fill and vent pipes. Make sure that vent piping ends outside and sufficiently above the ground to avoid being obstructed by snow and ice.
- Remove the oil tank fill pipe from the cellar wall. Removal will eliminate the possibility of accidental filling in the future.
- Plug the hole in the cellar wall using a wood plug or mortar as appropriate.
- Remove the oil tank fill pipe from the top of the tank. **DO NOT REMOVE THE TANK VENT PIPE.** Vent piping will allow excessive internal tank pressure to relieve if the tank is exposed to fire.
- Install a threaded plug in the top of the oil tank where the fill pipe was removed and tighten securely.
- Make sure that all plugs on the top of the oil tank are tightened securely with a wrench.
- Close the external tank valve on the oil burner supply line.
- Remove the oil in the burner supply line by operating the burner until the oil in the line is used.
- Disconnect the oil burner supply line. Cap the supply line at both ends. Cap the oil burner supply line at the tank.

If the customer does not want the oil piping removed or if site specific circumstances do not readily allow this, the installer can omit steps 2 through 5 above and perform steps 1, 2 and 3 below.

- Remove the cap from the oil tank fill pipe and insert an expandable plug in the fill pipe.
- Replace the cap on the oil tank fill pipe.
- Install a tag on the oil fill pipe which states that the tank is no longer in use.

2.51.00 MERCURY – HAZARDOUS MATERIAL HANDLING

Due to its toxic nature, handling mercury will be restricted under the following guidelines:

Storing or carrying mercury in company vehicles is prohibited except for mercury contained in sealed instruments or gauges and mercury contained in properly sealed old regulators being transported for disposal.
While working on mercury-sealed regulators, you may be exposed to mercury. Regulators in service and operating properly do not pose a problem, as the mercury is contained within the regulators. Mercury-sealed regulators found in the field shall be removed and replaced with a mechanical seal regulator. Mercury must never by removed from such regulators.

2.51.01 PROCEDURE:

The following procedures for the removal and transporting of mercury-sealed regulators have been developed to avoid contaminating you, company vehicles and customer property. These procedures must be adhered to at all times.

- Carry a suitable bucket and sealable plastic bags that are marked "MERCURY".
- Before removing the regulator, line the bucket with a plastic bag. Place the lined bucket under the regulator and put on work gloves.
- Shut off the gas supply to the regulator.
- Tap the vent line with a wrench. This will dislodge any mercury that may possibly be in the vent line from a blown seal.
- Disconnect the vent line and install a plug coated with pipe compound in the regulator vent tap.
- Disconnect the regulator outlet piping and install another coated plug in the regulator outlet tap.
- Disconnect the regulator from the inlet piping and install a coated plug in the regulator inlet tap.
- Place the removed, plugged regulator into the plastic lined bucket. If any mercury has come in contact with work gloves, discard them in the bucket and wash hands immediately. Seal the plastic bag with a tie.
- At the end of the workday, remove bagged regulators from vehicles and place them in designated covered containers. Mercury-sealed regulators must not be left in company vehicles overnight.

2.51.02 IN THE EVENT OF A MERCURY SPILL:

Any accidental spill of mercury on company or customer property must be left untouched and reported to the Manager of Gas Systems or designee immediately.